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NAME OF AUTHOR/*NOM DE L'AUTEUR* Greg Prygrocki

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NAME OF SUPERVISOR/*NOM DU DIRECTEUR DE THÈSE* Prof. Walter Jungkind

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THE UNIVERSITY OF ALBERTA

AN INTRODUCTION TO GRAPHIC COMMUNICATION

by

GREG PRYGROCKI

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF VISUAL ARTS

IN

VISUAL COMMUNICATION DESIGN

DEPARTMENT OF ART AND DESIGN

EDMONTON, ALBERTA

FALL, 1975

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled:

Final Visual Presentation
An introduction to Graphic Communication

Submitted by: Greg Prygrocki

in partial fulfilment of the requirements for the degree of Master of Visual Arts. (Visual Communication Design)

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Supervisor

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Date: 22nd August 1975

An Introduction to Graphic Communication

The intent of this thesis was to compile and organize information and ideas from various sources that may be useful as an introduction to visual communication design. More specifically its intent was:

1. to provide a context within which students could better appreciate the nature of the problems they are asked to solve, broadening their scope of consideration and ideas to include:
   a. aspects of general communication and information theory
   b. the concept of images(words and pictures) as 'signs' - mediating, surrogate events for the purposes of communication and expression.
   c. how perception affects what we see
   d. the underlying principles of perceptual organization - a visual syntax
   e. the relationship between the form and the function of images

2. to provide introductions to areas which students may wish to pursue with further research in solving specific problems.

3. to simply have this information compiled and available together in one place, so that a student can obtain an introduction to visual communication without having to spend a great deal of time in researching materials;
   in short, to give them a place to start.

The content has been broken into topic areas each of which, although part of a large sequence, is relatively self-contained. The material will be presented in two ways: first, as a moderately scaled set of panels for this exhibition and secondly, as a series of eight and one half inch by eleven inch pages, that could be reproduced in a booklet format, each panel being a double page spread.

Many of the sources from which much of the information was taken, rarely offered examples of applications to visual form. It is for this reason that an effort was made to balance off text with visuals to show rather than merely describe.

The organization of the thesis was based on five main considerations:

1. the term image refers to any mark or representation that is significant or meaningful to its creator, or meaningful to those who see it.

2. images are a means of communication they are part of a dynamic process and subject to unique situations in their perception and interpretation.

3. images reflect their creator's knowledge, emotions and perceptions; they must be perceived in order to communicate and when they communicate they act as mediating agents.

4. an image as a mediated perception has informational content

5. that if a viewer responds to an image in any way, that is if it affects behaviour, it acts as a sign.

Briefly, the emphasis of the thesis is on the functions of an image as a sign, its role in mediating information through the communication process.

Communication

The two most important external characteristics of human behavior are expression and communication.

Initially we may say that the first of these, expression, affects personal behavior and that the second, communication, affects social behavior. The aims of expression and communication, however, are closely related. It is impossible to consider one without at the same time considering the other. All communication originates from an individual's or group's wish or need to express an idea. The emission can be personal but the response or consequences may be social as well as personal.

Man has many natural ways of expressing his thoughts and feelings. Laughter is a natural expression of feelings of happiness or joy. That laughter communicates joy to all who can hear it.

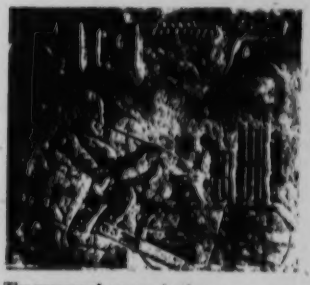
Man distinguishes himself from all other life forms by the degree to which he can willfully and purposefully express his feelings and communicate his ideas to his fellows. Indeed, these characteristics are fundamental to the development of ideas, knowledge and culture.

To live effectively is to live with adequate information. Thus communication and control belong to the essence of man's inner life in society.

Visual information began at the dawn of history: it is, in fact, recorded history itself. Human beings have expressed themselves and communicated with each other through simple scratchings on a rock as well as computer generated images displayed on a cathode-ray tube. The vast range of visual information includes the artist's painting as well as the system of visual letter signs by which we create words and sentences. These forms of information are said to be graphic; that is, created by man through writing, drawing or other means, natural or mechanical, which result in a two dimensional visual form. The process of visual communication as discussed here, then, will deal specifically with statements or messages that are graphic.

The evidence of our use of graphic communication can be seen everywhere. Books and magazines, street signs, drawings, photographs, paintings, and television are just some examples. The sounds of communication do not seem to influence us as forcefully as the sights. Seeing is believing. To be real, it seems that something must be visible as we generally trust the eye more than the ear.

Symbols, signs and pictures were the means of transmitting knowledge of the world to succeeding generations: *Throughout history, pictorial imagery and emblematic [symbolic] representation have aided man in making more complete and better defined records of his mores and his environment, thus making his life more intelligible and well ordered.* Even though our communications today have a strong verbal bias, graphic images can often tell or express more, in shorter time across language barriers, to a wider audience, than words alone.



The process of communication

In order to better understand the principles of graphic communication, it may be useful to first consider the elements involved in the communication process in general.

Communication: What exactly is it? How do we know when it's happening? When is it successful? We may consider the answers to some of these questions obvious; the answers to others may be more difficult to state clearly, and there are probably many more questions that should be considered if we are to understand what communication is.

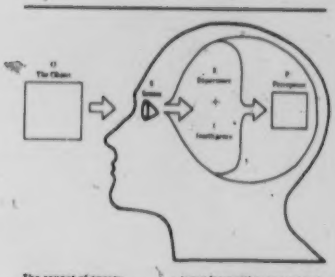
There are probably as many different descriptions and definitions of communication as there are books on the subject; though this situation need not be confusing, as the same characteristic ingredients tend to appear in most of them.

Communication is a process, a dynamic complex of interrelated events operating relative to each other in time and space.

The human functions of communication serve the purpose of mediating information across the boundary lines of the human organism or the group organization. Specifically, they solve the problem of how events outside an organism or organization are represented in terms of information on the inside, and how events on the inside are relayed to the outside.

This situation may be considered in terms of energy:

Living organisms emit behavior; they have output. The output of organisms is dependent on the energy impinging upon them--that is, upon their input.



The aspect of energy relevant to communication is its informative character. Information may impinge upon an organism from its surrounding environment, by way of its exteroceptors or as feedback from its own behavior. To the extent that an organism is responsive to input from either source and thereby modifies its output, it can be said to contain a *perceptual system*. A perceptual system, then, is one which relates input to output. Its function is to *help organize knowledge and thereby facilitate communication*.

As a person functions, he utilizes his perceptual system to represent his environment and the things that happen in it as information. Some factors that will affect his perception are:

1. his general physical, social and cultural characteristics
2. his mental 'set' (attitude, expectancy, predisposition, needs, values, etc.)
3. past experience (represented as knowledge which may help interpret new information)
4. the process of perception itself. Perception is selective; we must select what is needed from what is available, in the context of other events and things in a given situation.

Influenced by these factors, then, signals from the environment are evaluated and organized as a representation of a particular and unique perception.

In this way we gain knowledge and information which enables us to reconstruct past events, understand present events, and to predict and anticipate those of the future.

This 'input' information will result in some output behaviors. In considering communications, the particular behavior of interest is the emission of a *statement*. For our purposes we will say that a statement is emitted in order to elicit a response from an intended receiver.

Communication actions may be conceived of as events that occur in a certain *context*; that is, the composition of the perceptual field in which a particular event or statement is selected or perceived.

All perception, and reaction or response, takes place in a *situation*. Physical elements in a situation may be room size, location, heat, noise, etc.

Elements in a situation may be social, for example, group size, group composition, human relationships involved, or they may be procedural, as in the presentation or order of stimuli.

When a person observes an event and then wishes to make a statement about it, it must be represented or *codified* in such a way that it will be comprehensible to others. In human interaction some of the most frequent codification systems are personal appearance and dress, gesture, spoken words, simple sounds, and images. Thus any action or thing may be used in a formally coded statement that may represent other things or events.

Forms of communication may be grouped on the basis of two distinct kinds of coding.

Verbal language based on a phonetic alphabet and mathematics using a number system may be called *digital codification*. This type of coding deals with discrete sequential, step intervals, as in the various combinations of letters and numbers.

Nonverbal communications such as gesture, pictorial imagery and visual design may be called *analogic codification*. This type of communication is analogous to the actual thing it represents; that is, similar in the relationships of elements, proportions, movement, color, shape, etc.

The use of words has certain limitations:

Words or a series of words are emergent phenomena that, because of their step characteristics, lack the property or efficiency in representing continua or changes over time.

Analogic types of codification are of the greatest value in suggesting the quality of the continuance and the immediacy of impact implicit in the actual visual world.

While an action may take a fraction of a second, a considerably longer time is needed to report such an event verbally. The action, however, can be re-enacted through gesture in approximately the same time sequence as the original event. Pictures can describe an event almost spontaneously. Thus we may say that words lack the impelling immediacy of analogous devices.

Words identify or typify objects or events, but have none of their characteristics, and therefore must evoke some analogous representation in the mind of the reader or listener to have any significance.

CHAPTER I

In the late summer of that year we lived in a house in a village that looked across the river and the plain to the mountains. In the bed of the river there were pebbles and boulders, dry and white in the sun, and the water was clear and swiftly moving and blue in the channels. Troops went by the house and down the road and the dust they raised powdered the leaves of the trees. The trunks of the trees too were dusty and the leaves fell early that year and we saw the troops marching along the road and the dust rising and leaves, stirred by the breeze, falling and the soldiers marching and afterward the road bare and white except for the leaves.

The plain was rich with crops; there were many

The writer evokes nonverbal images through verbal means, and it is precisely those nonverbal images that make emotional expression possible.

A coded statement, be it digital or analogous, is the most distinguishing feature of communication as a process different from all others.

The manner in which a statement is codified determines its *form*.

Analysis of form may be structural, logical or psychological. Structural and logical analysis have to do with such internal relationships as design, style, organization, syntax, sequence, etc.

Psychological analysis has to do with such external relationships as conventional usage, connotation, association, feeling or attitudes evoked in users.

The *content* of a statement, that is, what it is 'about', is an attribute of a specialized form as used in a certain context and situation.

When a person makes a statement, he may be identified as the communicating agent, *source*, or *sender* in the process. The *transmission* of a statement from a sender to a receiver includes its emission, conduction and reception.

The *emission* of a statement is a specific kind of behavior. The statement is conducted from the sender to a receiver by some physical means, that is, through a *channel* in some controlled, codified fashion. A code can be said to be composed of information units which are appropriate to transmission via a specific physical channel.

The channel and the code together form the *medium*. The choice of medium will affect the form of the statement, the way it is perceived, its distribution and availability, and thereby have implications on its content and significance to the receiver.

The final stage of transmission is the *reception* of the statement. The process of reception need by no means consist in mere passive 'acceptance'.

Reception means the perception and evaluation of a statement by a receiver in a certain context and situation. Reception is thus subject to all the factors that have previously been considered in the process of perceiving. When a statement is perceived and interpreted by another person or persons, it is said to be a *message*.

A message may be defined as a specialized, formally coded or representative social event which makes possible inference about states, relationships, processes not directly observed.

In other words, a message conveys content in some form.

The receiver now has new 'input' information and will respond with 'output' behavior. This may result in a response to the message through commitment, action, understanding, acceptance, etc. The reaction of the receiver to *those external relationships which have referente to what the message is 'about'* is called a *communication effect*. Communication effects are measured against the aims of the communicator or the satisfaction of the receiver. When the sender and the receiver can consensually validate an interpretation of a message, then we may say that the communication has been successful.

Content also must be considered as *events and functions inferrable from messages taken as objective records of specific communication acts*. Whether we intend it or not, a specific message is not only a vehicle for codified representation, but also an objective social event: *It is not only a report, but also a record. As such, its content includes the imprint of circumstances and points of view which may be unintended and unrecognized but which are nevertheless functional qualities of the communication transaction*. In this way messages are a source of inference that may reveal some things about the process that produced them and the range of consequences quite apart from what sources (senders) and receivers intend or mean by them. The *consequences* of the communication act are the sum total of changes or responses brought about, including *effect outside the scope of those desired, anticipated, or recognized at any one time*.

The direct or indirect observation of the response of a receiver and the consequences attending the communication act may provide the sender with *feedback* information. This feedback may indicate to the sender how successful his communication has been.

The success of the communication will depend largely on the communication and media skills of the participants, that is, the sender's ability to encode a message in a comprehensible form and the receiver's ability to decode it successfully.

Finally, any interference which affects the transmission, reception or interpretation of a message is termed *noise*.

The first step in any purposive communication act is having something to communicate that is knowledge. There must be 'input' before there can be 'output'; we must have information before we can emit information. How is it that we know something to communicate?

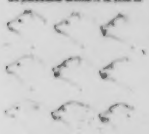
For the human species, the attainment and sharing of knowledge has been a matter of survival.

To survive is to anticipate correctly environmental events.

Anticipation of future events must rely on hypotheses, based on and confirmed by a particular 'input' information, resulting in suitable 'output' behavior. That is, organisms survive by responding to certain information in anticipation of a particular event.

When animals, or children or boxers fight, each movement of one of them determines a corresponding movement in the other, a genuine response to it. Every gesture is understood as a sign, possessing significance which the adversary must anticipate as quickly as possible while it is still in a rudimentary stage, so as to foresee what will happen when it is complete. A clenched fist proclaims the beginning of a fight ... but it also may be a feint. But one must not wait until one's opponent has completed his movement and dealt a real blow, because then it may be too late to reply.

Signs of fear and agression in animals may foretell their behavior.



The context of a gesture may determine its significance as a sign.

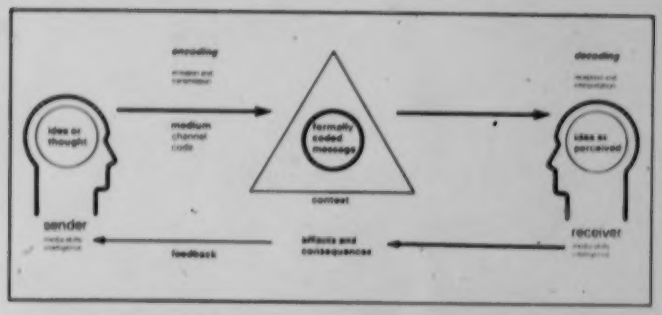
Knowledge may be defined as 'the sum total of these hypotheses', accumulated in three levels:

1. the molecular level of the genetic structure of species, which tests the validity of its hypotheses, as various mutations, through natural selection.

2. the level of an individual organism's ability to adapt and learn.

3. the social level through symbolic communication which cumulatively passes information from generation to generation.

At the first level knowledge is innate or instinctive, but at the other two it depends on information received through experience.



We may say that human beings gain knowledge through three types of experience:

1. The first is through action. There are many things we know, for which we have no imagery or words. You know how to run up stairs, climb a ladder, ride a bicycle or perhaps even play tennis. These activities are based on the learning of responses and forms of habit, as a result of actually doing things.

2. The second depends upon the organization of visual or other sensory data and upon the use of 'summarizing images'. This is governed by the principles of perceptual organization and by economical transformations, such as completing forms by filling in missing components, etc.

3. The third is experience in a symbolic system. Such a system is based on symbolic units that are arbitrary in the sense that they are not analogous to what they represent, that is, they are remote in reference and rely on convention for meaning.

$$E(X) = m \sum_{g=1}^{\infty} \frac{e^{-m} m^{g-1}}{(g-1)!} = m \sum_{g=0}^{\infty} \frac{e^{-m} m^{g}}{g!}$$

This stage is highly productive in the sense that a symbol system has rules for the formation and transformation of statements that can extrapolate the reality of an event beyond what is possible through action, by questioning the event, making predictions from it, etc.

A mature human being seems to go through a process of elaborating three systems of skills that correspond to *the three major tool systems to which he must link himself for expression of his capacities--tools for the hand, for the distance receptors, and for the process of reflection.*

Sensory information is necessary for the co-ordination of our actions, the awareness of our environment and the perception of symbols.

1
Gelb, I. J.
A Study of Writing

2
Wiener, Norbert
from Frank, Lawrence K.
in Kepes, G.
Sign, Image, Symbol

3
Hamelton, Edward
Graphic Design for the Computer Age

4
Ruesch, Jurgen and Kees, Weldon
Nonverbal Communication

5
Dember, William
Psychology of Perception

6
ibid

7
Ruesch, Jurgen and Kees, Weldon
Nonverbal Communication

8
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9
Gardner, George
in DAVI
Visual Communication

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15
Von Foerster, Heinz
in Kepes, G.
Sign, Image, Symbol

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Arangueren, J. L.
Human Communication

17
Bruner, Jerome
Towards a Theory of Instruction

The Importance of Vision

Perhaps the simplest way of reminding us of our reliance on vision is to deprive ourselves of that aspect of our perceptual system. Close your eyes. If you are alone, content to sit in a chair or stand still, you may not feel deprived at all. But if you are standing on the sidewalk of a busy street, a sense of uneasiness is almost immediate. Not only are mere patterns of light, dark and color missing, but we are also deprived of a primary means of gathering information about and orienting ourselves to our environment. Unless you can utilize your remaining senses, as the blind have learned to do, functioning in your environment may be difficult, if not impossible, and probably dangerous.

Indeed, the development of all the senses came about as biological mechanisms that facilitated the survival of organisms in their surroundings. The functioning of the senses from the beginning made it possible to be aware of and concentrate on those features of the environment that made the difference between the enhancement of and the impediment of life. The functioning of perceptual systems has therefore been purposive and selective.

The use of information gathered by the senses allows an organism to operate more efficiently in its surroundings than does total insensitivity. Therefore, an insect, with an inbuilt tropism which causes it to seek or avoid light, or a clam, which reacts to changes in brightness through its light sensitive nerve, operates to the same end. The capacity to sense changes in the environment and to react to those changes is fundamental to the struggle for survival.

Man has used his senses not only as a means of survival, but also as instruments of thought, the means to the enrichment of his life. The psychologist Rudolf Arnheim has declared: *nothing is in the intellect which was not previously in the senses*. Our perceptual system, our sensory organs and the related parts of our brain, then, gather and process the information that enables us to cope with the world.

Some psychologists claim that the human being is the most 'eye-minded' of all living creatures and that approximately 80 per cent of learning occurs through vision. Although this could not be systematically proven, there is no doubt as to the importance of vision in perceiving our world. Research has indicated that vision may account for up to two-thirds of the 3,000,000 impulses processed by the brain every millisecond.

Man has a complex visual system, enabling him not only to understand his immediate environment, but also to modify it, creating new and often more complex surroundings in which to live. We need only recall the torrent of visual stimuli that confronts us as we negotiate a car through a city street. Vision itself has been modified to extend man's perception to the depths of space and to microscopic worlds of living cells.

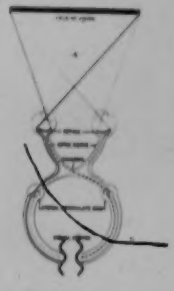
Man's eyes have developed as those of a hunter, and while not the most accurate, or widesweeping, or best suited for underwater or night vision, their versatility and adaptability, accuracy and precision are amazing; they are capable of extremely rapid movement and immediate changes in focus, from the very near to the infinitely far; they readily adapt to light conditions and distinguish between a vast range of colors.

The human visual system is adept at estimating distance, size and direction of movement, and is able to perceive three dimensional space and planar representation of space. Unlike our hand which, through our sense of touch, can only explore a few things at a time, our eyes can scan our surroundings, focusing in on what is relevant to our needs.

A particularly valuable trait of vision, as it is of hearing and smell, is the capacity to obtain information from an object or event at a distance. These 'distant senses' allow perception to go beyond the immediate effects of what the perceiver does or of what acts upon him and to objectively observe his surroundings. This not only broadens his range of knowledge, but also removes him from the consequences of direct contact with what he perceives. Seeing someone recoil from a stove in pain, or observing its element glowing, the viewer knows the stove is operating.

Visual perception is active, a dynamic process of gathering stimuli and organizing them in a manner meaningful to performatory activities in our surroundings. As such, it is closely linked with the rest of human behavior. We live and function in a three dimensional world; as we see with our two eyes and experience the input from our other senses in moving about our environment, we learn about shape and depth. The movement of our eyes, body, arms and legs gives some spatial meaning to vision. Vision, then, is an act mediated by the eye and brain, although the development of perception grows out of an 'action system'.

Perception is a problem solving process.



Merely experiencing a stimulus is of little help in formulating knowledge of the world. The visual system, then, does not act simply as a camera passively receiving and recording various stimuli, but rather the eye and brain must select, organize, analyze, and process masses of inputs and to create useful representations upon which to act.

New information is analysed and compared with past experience. The perceptual system will seek 'information redundancies' to confirm the significance of a stimulus. One single stimulus may be inadequate to form a correct percept or may be ambiguous without any correlation with other perceptual clues. Of necessity, then, there is an extensive relationship between vision and the other senses, as they co-operate with and augment each other.

Generally, the input from the various senses acts harmoniously; but occasionally they may provide inconsistent information, in which case the input that has been most reliable in past experiences will likely determine the perception.

As mentioned previously, visual perception is active; it is also selective. Discrimination in the selection of input stimuli is critical to perception. William James described the importance of selectivity this way:

Millions of items of the outward order are presented to my senses which never properly enter into my experience. Why? Because they have no interest for me. My experience is what I agree to attend to. Only those items which I notice shape my mind--without selective interest, experience is an utter chaos.

We need only consider functioning in a familiar but complex environment, as when we drive through a city street, to appreciate James' statement. The vast array of colors, shapes, lights and movement bombard our eyes. Without selective regard to those stimuli necessary in negotiating a vehicle through traffic, such a task would be impossible.

It may be generally stated that no stimulus can be reacted to unless it is selected and distinguished in perception. There are, however, *sources of experimental evidence that seem to verify the general hypothesis that a person can respond to input of which he is unaware.*

The most obvious way of selecting what we see is by changing the direction of our body and through the movement of our head and our eyes. As we focus on various aspects of our environment, we selectively concentrate on some items and ignore others. Further, the process of recording within the eyeball is highly selective. Accurate vision is limited to a small portion of the retina, and an objective must then be selected from the total visual field. Such limitations govern the amount of information the mind can or needs to process at any one time. There is also evidence that specialized receptors that can only react to certain stimuli and not to others exist in the eyes of animals and also man.

Selectivity is also an active concern of the mind. There is a definite limit to the amount of information which the central levels of the perceptual system can process. The central levels can only do a certain number of things at a time and can attend to only a small amount of available information.

The nervous system *transfers electrical impulses from the sense organs to the appropriate processing units housed within its boundaries.* Some cells in the visual cortex, for example, are specially adapted to analyze line segments, visual orientation and movement.

From the incredible cross-currents of activity--data gathering, sorting, integrating, decision making, monitoring, controlling, cross-checking, storing, and recalling of memory traces--the control headquarters of the nervous system transfers the only language it can understand into the integrated and synchronized activity which is known as conscious human experience.

The central processing units first perform the extraordinary activity we know as perception and then further integrate all perceived information into a form suitable for storage and recall.

The perception of shape is dependent upon the application of the appropriate form categories or 'visual concepts' of shape to stimuli that have been received. That is, the mind filters or screens the stimuli according to certain characteristics of shapes. Motivation and perceptual 'set' will also determine what we perceive.
If a pattern or a group of stimuli forms a perception that determines the shape of an object, it acts as a cue. A cue may therefore be defined as a 'perception having problem solving properties'. For example, some of the cues that may determine the perception of space are the relative sizes of objects, linear perspective and interpretation of objects in front of each other.

Selectivity allows the most economical use of the perceptual system by facilitating the process of visual organization. It is the process of organization, in an effort to find significance in our relationships with our environment, that ultimately determines perception. Selecting what is needed from the mass of available information, using the rest of the information as a background reference, comparing this new information with past experience, and making decisions, the perceptual system organizes a meaningful vision of our world.

The eye comes always ancient to its work, obsessed by its own past and by old and new insinuations of the ear, nose, tongue, fingers, heart, and brain. It functions not as an instrument self-powered and alone, but as a dutiful member of a complex and capricious organism. Not only how but what it sees is regulated by need and prejudice. It selects, rejects, organizes, discriminates, associates, classifies, analyzes, constructs. It does not so much mirror as take and make; and what it takes and makes it sees not bare, as items without attributes, but as things, as food, as people, as enemies, as stars, as weapons. Nothing is seen nakedly or naked.

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4
ibid

5
Goodman, Nelson
Languages of Art

The Means of Communication

Visual perception is literally the capacity to interpret or give meaning to what is seen. Every act of seeing is a visual judgement that occurs in a particular context and situation, governed by certain motivational drives, previous knowledge and attitudes at a particular moment in time. Each perception then, is individual and unique, and is therefore unlike anyone else's. When you describe what you have seen, you are also describing the events within your perceptual system in its interaction with the events outside you. How can we communicate if each of our experiences is personally unique? How do we arrive at a common meaning for an object or event? If you walk around an object, a chair, the multiplicity of images, in total, describe its 'chairness'. That is, you perceive the necessary cues from each image pattern as a set of features or structural relationships that describe the generic qualities of a chair. If someone else now walks around the chair and looks at it, he or she will have different individual experiences from each viewing angle, but will perceive the critical succession of features that give us the experience of 'chair'.

For each of us this experience of a chair is represented internally as knowledge.

A distinction is possible between what is commonly called experience at first hand and experience at second hand. In the former, one *becomes aware of* something; in the latter one is *made aware* of something. The process by which an individual becomes aware of something is called perception.

The process by which an individual is made aware of something involves the action of another individual besides the perceiver. This process involves 'being informed, being told, being shown', etc. In other words, it involves the transfer or transmission of information from one individual to another--that is communication.

In order to communicate our experience of an event, we must create a new event, a mediating experience. We can define this 'surrogate' event as *a stimulus produced by another individual which is relatively specific to some object, place or event not at present affecting the sense organs of the perceiving individual.* Our surrogate event, then, is like any other event in the environment, and is received as such. The event we create is not the event it reports on--it is a new event entirely.

A surrogate event, as defined here, *is not the same thing as a substitute stimulus or a preparatory stimulus or a conditioned stimulus as these are ordinarily defined in psychology, for these include merely physical conjunctures of events. Clouds are not a surrogate for rain, nor is the smell of food a surrogate for food. These are signs, but not surrogates.* The definition is concerned with the *mediating of a perception.*

Everything, every organism, and every event that happens, emits by its own existence characteristic identifying signals. Through evolution, even the most primitive organisms have developed capacities to sense and respond to those signals which are essential to survival in their surroundings. We may say, then, that signals act on underlying perceptive mechanisms of an organism, affecting basic behavior and organic functioning. These developed capacities to respond to the environment, often sharpened by learning, have determined the survival of species through 'natural selection'.

However, organisms are not limited only to receiving the characteristic signals of the elements in their environment. One signal may be experienced concommitantly with another signal, and when the relationship between the signals is recognized as significant, that is, when one signal can act as an indicator of the other two, it operates as a sign.

If you stand outside on a windy day, you may note two experiences. First, you can feel the pressure of the wind blowing. Second, the branches of the trees that you see are bending and swaying. Every time you go outside on a windy day you will have these experiences. Through this, a significant relationship between pressure of the wind and the bending of trees may be established. If that is the case, you need only look out the window and refer to the bending of the trees to know that the wind is blowing with some force. The bending trees become a sign.

An organism is naturally conditioned, and learns to recognize as signs those signs which occur concommitantly, or just preceding, or just after the occurrence of another signal. The organism thus becomes responsive to a substitute or referent of a signal, and no longer has to experience the signal itself in order to modify its behavior. Signs may refer to past or present experience, but their significance relates to future behavior.

The traces of a predator in the snow may indicate to a hunter that the animal is near and he will act with caution. Obviously this capacity for learning to recognize signs or precursors of biological situations is of great advantage to organisms, enabling them to devise strategies for exhibiting some degree of flexibility for purposive behavior. That is, the sign has anticipating value, making it possible to get ahead of events and avoid modifying them.

Signs themselves have no message content, and therefore must be interpreted or deciphered. The significance of a sign relies on the context in which it is experienced or learned. It recalls through association the experience of another signal that is relevant to its future action:

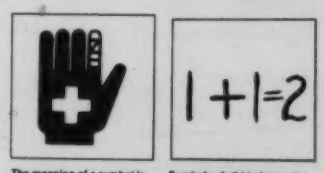
- *Man's existence and functioning as an organism depends upon recognition and response not only to biological signs, but also to the wide variety of signs which he learns to perceive and interpret as guidance for orienting and directing much of his patterned conduct.*

He has been able to perceive and identify patterns of signals in nature, and name and label them with symbols. Symbols have evolved out of signs, and operate to increase the efficiency of signalling.

Symbols are, in effect, signs in the second degree, and therefore can be substituted both for signs and their referents. The presence of smoke is a sign of fire; the word 'fire' is a symbol that stands for fire itself, and may be substituted for any of its sign indicators. If the word 'fire' is recognized as such, it then has meaning to its users.

Symbols are a creation of man, existing only in his mind, as tools to transform the world of signals and signs that he perceives into meanings and values. This unique capacity developed in the human species for 'information processing' has left us with symbols that are interpreted as meaningful messages to which we respond with purposive conduct.

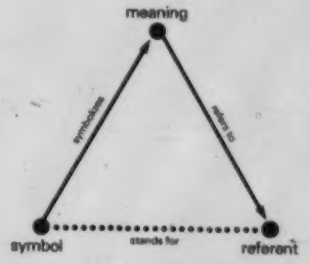
- ***Symbols, in the proper sense of the term, cannot be reduced to mere signs. Signals and symbols belong to two different universes of discourse; a signal is part of the physical world of being, a symbol is part of the human world of meaning.***



The meaning of a symbol is established through its agreed upon use within a group and is maintained through tradition. Therefore, people must learn to recognize and use them, in a context appropriate to the meaning that is intended.

Symbols of all kinds may be highly ambiguous as each individual of a group learns and uses them in his own idiomatic way.

Signs operate in the place of and with the same authority as their referents. Symbols cannot and do not act in the same way, because the symbol has no significance in itself. Symbols only become meaningful when the perceiver projects a learned meaning into it and responds accordingly.



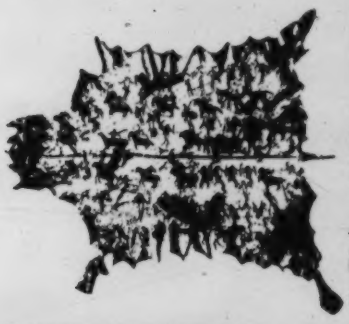
Roses may be used to symbolize passion. In a communication act there is a signifier or referent and something signified; in this case, roses and passion. Both existed before uniting and forming a third object.

which is a symbol. The roses cannot be confused as both a referent and a symbol; the referent is empty, the symbol is full- it has meaning. A symbol is the associative total of a concept and its referent.

- *To cumulatively acquire knowledge by passing it on through generations, it must be communicated in symbols and not in signs. This separates man from beast. Communication among social insects is carried out through inalterable signs which are linked to the inalterable genetic makeup of the species. While signs refer to objects and percepts, and serve to modify action and manipulations, symbols refer to concepts and ideas and serve to initiate and facilitate computation.*

Some time in the development of the human species man *began to create symbols for communicating with the world and the larger universe, with other human beings and himself, according to his beliefs and feelings about and toward those foci of his concerns.*

The first communications were nonverbal signs. Interpersonal communications probably started with changes in stance and position (such as bowing and kneeling, gestures of the arms and hands, nodding of the head, facial expressions, whistling and varied voice sounds, which apparently later gave rise to articulated language). Vocal tones and gestures elaborated into dance may have been used in early rituals to communicate such things as group solidarity or to invoke favors or protection. Other signs such as fire or smoke may have been used to communicate over greater distances than sound or gesture would allow.



Symbols developed within groups as an accepted expression of elements or events in their common environment which were of significance to their way of life. Through symbols the world could be represented in a meaningful way, thoughts could be conveyed, and patterns for group conduct could be established.

The most important system of auditory communication is the spoken language directed to the ear of the person receiving the communication.

Language is universal. Within the system of human knowledge there has never existed a group of men who have not possessed a fully developed language.

When there have been natural or artificial restrictions on the use of language, there has been the development of systems of communication based on gesture and mimicry. For example, the sign language which developed and allowed communication among the various tribes of Plains Indians, who all spoke mutually incomprehensible languages, or the sign language the deaf use today.

All the means of communication that have been discussed have two features in common:

1. First, they are all of momentary value, that is, as soon as the words are spoken or the gesture made, the message is lost and cannot be retrieved (except by repetition); therefore, there is no permanent record of any ideas exchanged or of communication having taken place.

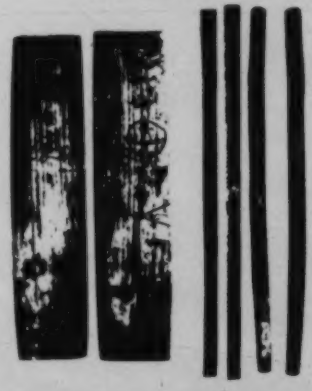
2. Second, the messages that are transmitted are limited to the distances of hearing and visibility, and therefore cannot span great distances.

The need to overcome these limitations of time and space resulted in the development of communication by means of objects and markings.

Communication through the use of objects was achieved in a variety of ways. This type of communication can be classified into two main functions.

Memory Devices

Objects were used to keep account of numbers. For example, a notched stick might indicate the number of fallen warriors in a battle, or pebbles in a bag might be a record of the number of cattle in a herd; knots in a string may have been used as a calendar. Objects were also used as memory aids in recalling events or objects and beings. Wampum, strings of colored shell beads tied together in knots, were used by North American Indians as communication devices as well as for money. Colors were coded to certain meanings which could only be deciphered by educated men who had memorized their significance. The meanings given to the beads or colors were not, however, recognized universally.



Symbolic Devices ('Talking Things')

Objects acted as communication devices through their symbolic significance. This significance was often, but not always, related to the object's function. Sending someone a spear could act as a threat or an indication that war was impending. However, the message value was often ambiguous as there were no conventional meanings. Three different readers might interpret the same object and get three entirely different messages.

The most natural way of communicating by means of visible markings is through images. Before going on to describe their functions, as used by man, the term 'image' should be defined.

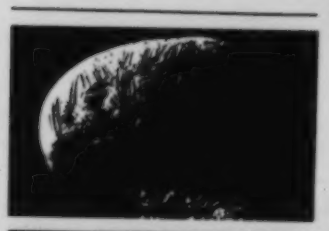
The common use of the word, and indeed its definition in the Oxford Pocket Dictionary, limits an image to 'the imitation of an object's external form'.

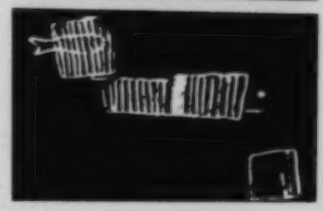
Image, as it is used here, has the much broader application of a representation. To 'represent' means to 'call up by description or portrayal or imagination, figure, place, likeness, or before mind or senses, serve or be meant as likeness of' but also to 'stand for, be specimen of, fill place, be substitute for'.

The function of images can be described in terms of their historical origins. Through the course of time images tended to develop in two directions.

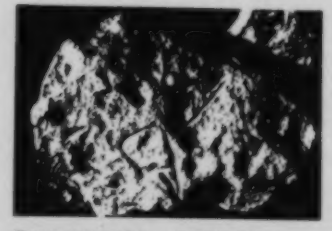
1. Pictorial images, in which pictures refer through their resemblance directly to people, animals, things or events, independently of language.

2. Writing, in which the image, whether it is pictorial or not, represents a linguistic value, and does not directly refer to organisms, objects or events.





Images appear at the beginning of man's urge for expression, his first attempts at declaring his existence. The first markings were but parallel and diagonal lines or circles engraved in the bones of animals and images scratched on the surface of rocks or walls of caves. These symbols are so fragmentary that it is impossible to determine their significance.



The recognizable symbols that appear most frequently and over the longest periods of prehistory are simply parts standing for the whole: hands representing the whole human being and genitals representing fertility. Such symbols are found alone, but more usually they are found associated together, interrelated. These composite symbols put individual meanings in the context of the whole, and therefore made them more articulate.

Besides simple representational symbols, there existed complex, entirely abstract or geometric forms developed in primitive times.

The symbols of primitive man are rooted in the primary demands of human existence, *«the need for expressing the disquieting and intangible relation between life and death.*

« Image making activity begins *when man finds himself face to face with the visible world as something enigmatical.* In the creation of images man engages in a struggle with nature not only for his physical but also his mental existence.

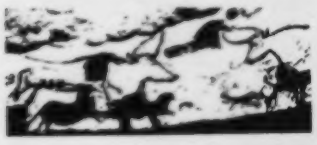
« This marks *the dawn of specifically human consciousness: a consciousness not yet logical, not aware of causality, but aware of synchronicity--able, that is to say, to make a mental connection between events that are separate in location. To make a connection was the first step in civilization, was the basis of the first magical economy. But a connection could only be made--that is to say, rendered visible, perceptibly realized and represented--by a sign, which is an image that can be separated from immediate perception and stored in the memory. The sign came into existence to establish synchronicity, in the dumb desire to make one event correspond to another.*

The main preoccupations of prehistoric man, as of the human race always, were economic. The driving need of man was to secure sufficient food to live. Men of the stone age hunted to live, for animals were both their food for life and their predatory enemies. No single element in their environment could have been more important. Success in the hunt meant life itself. The only priority in human development is the vital one—the will to live.

Out of this priority was born magic, the attempt to influence events from a distance. When direct attack on an animal was not successful or if no animals could be found, the wishful thought that man could bewitch the animals, or that they would become plentiful, was expressed as a rite, a ritual.

But ritual could not have developed without a system of signs, gestures elaborated into dances and images.

It is not surprising, then, to find animals as the dominant subject matter of early drawings.



The earliest pictures show animals standing, as portraits, sometimes as just an outline, other times painted in with a modeled three dimensional effect. Later on, animals were pictured in action: horses galloped and stags were shown swimming. These are the first attempts at telling a picture story.

Eventually people were included. However, like the first animals that were depicted, they are only standing, sitting or lying down; they are statements on the order of 'this is man'. Finally depictions of men and women were drawn showing them running, hunting and fighting, animated in the picture story, and describing their lives, needs and aspirations.

In the comparison of the images of men and those of beasts, we can see a difference in the approach to representation.

Although often simplified in form, animals always appear 'naturalistic', while the figures of man are highly 'stylized' or distorted. The simplified and distorted symbols of the hunters were not intended as a visual realization of the human figure. They are ideoplastic, determined by subjective sensations, and in extreme cases, in their economy, only bear a minimal resemblance to human form. They had no magical qualities, but rather were descriptive devices.

The images of the hunters depict action and movement. Rather than being the result of style or mannerism, these figures are 'kinetic' or 'haptic', that is, they are determined by the inward sensations of movement rather than by outward observation: *Running limbs are lengthened because in the act of running they feel long*. The elongations and other exaggerations of haptic art are the result of instinctive expression, subjectively determined.

The images of the beasts, on the other hand, were drawn from outward observation, that is, visual perception: *The reproduction externally of a perceptual image is a very different process, calling for a perfection of sensorimotor co-ordination which can only have been developed under biological stress*. The required stress was the combined danger of hunting and the need for food. During the course of centuries the life and death struggle with the animals as the stress source impressed on the brain of man the necessary powers of observation and familiarity of the animal form, concluded in the essential living image. The environment and the food that was easily found or caught without danger called for no magic or revealing image.

A capacity to retain the perceptual image was developed and became the foundation of an intelligence specifically human. Certain images, as those involved in the acquisition of food and fertility, probably had a priority in this development. According to Jung, physical imprints of perceptual imagery, impressed on the brain of man over the centuries, as was the image of the animal, result in a predisposition toward images that conform to their patterns. This is the concept of the archetype, an *inherited structure of the brain predisposing the human race, at certain epochs to the invention of particular kinds of symbols*.

Although this theory is outmoded in light of current knowledge, we may say that a correspondence was established between the efficacy of the image as a symbol, or as a totem, and its vividness as a representation of the animal's essence. What was recognized as most vital was accepted as the collective symbol.

The vitality achieved is selective, concentrating on the aspect of world that for the moment was of predominant biological significance. Image making *at the dawn of human culture, was a key to survival—a sharpening of faculties essential to the struggle for existence*.

The stage in the development of visual communication where pictures convey the general meaning intended by their creator as purely descriptive devices can be described as a forerunner of writing. Visible forms, like gestures, were used to express meaning directly without the use of intervening linguistic forms, and are therefore a primary means of interpersonal communication.

Two approaches to meaning were used in this early picture writing. The pictograph or pictogram may be defined as a picture symbol representing the person or thing shown; that is, a pictograph represents nothing more than the object it portrays (a 'thing picture').

The ideogram is a picture symbol that does not represent an object or being so much as the underlying idea associated with them. Thus the image of a sun-like form might mean light or heat (an 'idea picture').

The demarcation line between pictogram and ideogram is impossible to fix because of the gradual evolution of the former into the latter. One stage was not abandoned when the next began and they often co-existed.

Early writing can be divided functionally into two groups:

1. *Descriptive-representational devices*

These devices differ visually from images used as art or for decoration. They contain only those elements which are important for the transmission of a particular communication and lack aesthetic embellishments. Such devices were generally used to describe events, to show how something was done, or to act as a warning.

2. *Identifying-mnemonic devices*

These devices were used as identifying symbols or memory aides for recording people or objects. Thus, a correspondence was established between object or being and symbol. Since these objects and beings had by this time names in the oral language, a correspondence was established between written symbols and their spoken counterparts. Once it was discovered that words could be expressed by written symbols, a much better method of human communication developed.

The depiction of objects could be easily achieved through direct resemblances, that is, pictograms. Ideas or concepts and things that could not be seen were expressed through ideograms. Thus strength became a flexed arm, motion was two legs, joy was a flower.

The concept which was verbalized as 'a man killed a lion' no longer had to be expressed by a representation of a man in the process of killing a lion. The idea could be expressed by means of three conventional symbols: a man, a spear (the written equivalent of the verbal word 'killing'), and a lion.

When stories became more complex, it became useful to represent word symbols with the very minimum of strokes; thus the complexity and representational character of word pictures were reduced.

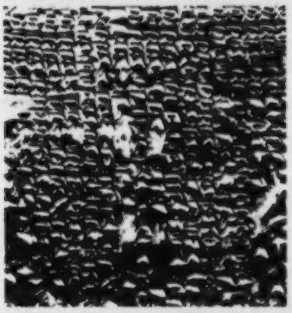
As characters were used to express not only specific objects but also abstract ideas, one symbol took on many different meanings--and so the symbols became ambiguous. This problem was solved by adding determinatives. These were not spoken, but were used to indicate to the reader which of many meanings a symbol was intended to have. The determinatives were not specially invented, but were drawn from existing ideograms. For example, man was represented with a dot for the head and lines for the limbs and body. It was found that by adding other symbols they could create characteristic features. Thus a man with the addition of a spear became a warrior, with the addition of a walking stick became old.

Another use for combining symbols was in expressing actions. Weeping was represented in combining the symbol of an eye with a symbol for water running through it.

Other determinatives were later used to indicate how a given character should be spoken.

The transition from pictograms to ideograms also brought with it new difficulties. Ideograms became intelligible only to those who were instructed in their use and were consequently difficult for strangers to interpret. Also, symbols might be drawn quite differently by different writers and might not always represent the same idea or thing. Ever increasing ingenuity was required to invent new idea pictures for more complex concepts.

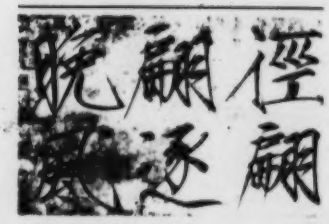
A device by which individual signs can express individual words should naturally lead toward the development of a complete system of word signs, or logography. However, the creation and memorization of thousands of signs for thousands of words and names existing in a language is so impractical that logographic writing can be used only as a limited system or it must find ways to overcome these difficulties in order to be useful.



The first step to a fully developed system of writing was taken by the Sumerians of Mesopotamia in 3100 BC. Through the necessity of expressing proper names to prevent confusion in their records, their logographic system of writing was expanded to a word-syllable system. Thus, the Sumerians were able to break away entirely from the hampering convention of the representational descriptive devices.

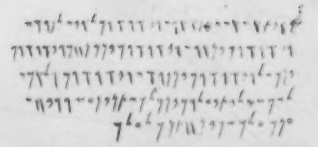
Phonetization, therefore, arose from the need to express words and sounds which could not be adequately indicated by pictures or combinations of pictures. Its principle consists in associating words which are difficult to express in writing with symbols which resemble these words in sound and are easy to draw. Thus, in Sumerian the syllable 'a' came from the word sign 'A' for water.

The people who used logographic writings certainly did not distinguish between the logographic and syllabic signs in the manner we do. What they knew about their writing was that all signs stood originally for words of their language and that under certain conditions, some of these signs could be used as syllables.

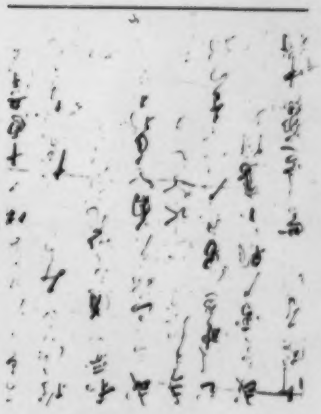


Even Chinese, the most logographic of all writings, is not a purely logographic system, as it has from earliest times used word signs functioning as syllabic signs.

Once introduced, the principles of phonetization spread rapidly. With it, entire new horizons were opened to the expression of all linguistic forms, no matter how abstract, by means of written symbols. The establishment of a full system of writing required conventionalization of form and principles. The forms of characters had to be standardized so that everybody would draw the signs in approximately the same way.



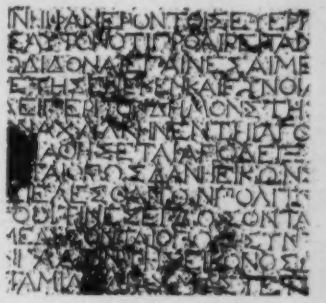
Some peoples found the task of mastering the Mesopotamian word-syllable system of writing too difficult to use. They in turn took over a simplified syllabary and eliminated the logographic symbols almost entirely. Eventually, systems such as the Semitic were developed that were nothing more than mono-syllabics.



The Japanese used a simple syllabary, with word signs taken from the Chinese.

If we use the word 'alphabet' to describe a system of writing signs which expresses the single sounds of a language, then we may say that the Greeks were the first to form an alphabet.

The alphabet is the result of the distillation of visual symbols until they become phonetic signs. These signs have in turn been combined in 'a kind of mathematics of meaning' to create word symbols which represent the most subtle thoughts of which we are capable. The impact of this means of communication with the advent of printing evolutionized man's access to knowledge, *for through the word man voices his own inwardness, symbolizes his thoughts and emotions, and gives expression to himself, the focal reality.*



„ *Word and image form the bridge between one human being and another. They are the links between the mind and the physical world, and the world of other people.*

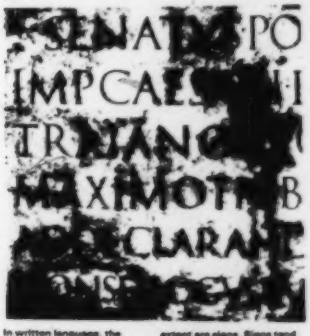
The images of man serve different functions in his efforts in expression and communication. Visual images act as signs, pictures and symbols. These functions, however, are not mutually exclusive, and one image may serve more than one of these functions.

Although we have already discussed these functions generally as historical developments in visual communication, it may be useful to define them more specifically.

Signs

Signs are indicators. They stand for or refer to an organism, thing or event without reflecting any of its characteristics visually. Signs operating as mere references cannot be used as media for thought in their own right, and may therefore be considered as indirect media.

The visual characteristics that signs possess are derived from requirements other than those of portrayal. For example, the triangle shape of 'danger' or 'yield' signs is distinctive in relation to other signs, and therefore acts as a sign referring to the symbolic message it bears.



In written language, the variety of letter groups serve similar purposes of identification and distinction of phonetics, and therefore letters and words to this extent are signs. Signs tend to be chosen or evolve in this way and cannot be said to be arbitrary.

Pictures

Pictures are visual analogies. They portray or render some relevant qualities of their subject, such as shape, color and movement. Pictures are *not* mere replicas, that is, faithful copies that differ from the model by random imperfections in their execution.

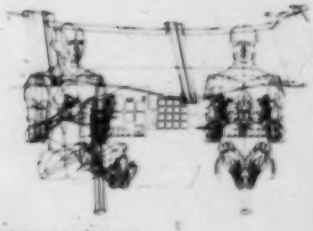
All pictures are abstractions from reality. Abstraction is a means by which the picture interprets what it portrays, revealing something essential.

A picture is a statement about visual qualities, and such a statement can be complete at any level of abstractness.

A photograph or a Dutch landscape of the 17th century can be quite life-like; yet they are more than replicas. They almost stylize or view the subject in such a way as to focus on some of its essence. In the same way, a child may capture the character of a figure by a few highly abstract circles, ovals or lines.

Only when a picture is incomplete, imprecise or ambiguous with regard to abstract qualities is the observer called upon to make his own decision about the nature of what he sees.

Abstract or nonmimetic images have only intrinsic form; there is little or no attempt at pictorial representation, but rather the portrayal of essential or relevant qualities of the subject. These images tend to be affective or emotive.



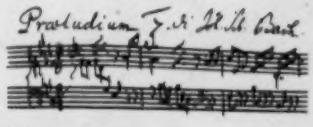
Schematic images describe arrangements as relationships, plans or structures. They explain rather than depict; that is, they are analytical.

Iconic images are realistic representations that have meaning through their direct resemblance. Thus, form is largely governed by visual considerations.

Symbols

Symbols give visual shape to ideas or forces. An image represents a particular thing; by standing for a kind of thing it serves as a symbol, as in the image of a dog representing the concept of 'dog'. In principle, any thing or any replica of a thing can serve as a symbol if someone chooses to use it that way. Thus, a tree becomes the tree of knowledge and a cross, the symbol of Christianity. A picture, then, can be a symbol; this, however, leaves the abstracting entirely to the viewer. In such a case focusing in on pictorial details or features is of no help in identifying the symbolic significance of an image.

Holbein's portrait of Henry VIII is a highly realistic picture of a particular king. It is also, however, a symbol of kingship, of qualities such as strength, power, exuberance, brutality, which represent concepts of a higher level of abstraction than the painting itself.



Musical notation serves as both sign and symbol. The notes themselves are signs, but their structural relationship of position on the staff is analogous to the pitch levels of sound.

Images as symbols can give manifestation to finished thoughts and dynamic processes, through visual models. For example, physicists use arrows to depict vectors showing relevant qualities of forces, namely strength, direction, point of application.

Pictorial and symbolic images can depict experience in two complementary ways. We may say that a pictorial image, being a representation, is at a higher level of abstraction than that of the experience it represents. With symbolic images, the opposite is the case. When an image acts as a symbol, it represents concepts and forces that are not seen, and therefore it is at a lower level of abstractness than the symbol itself.

1
Gibson, J. J.
in Kepes, G.
Sign, Image, Symbol

2
ibid

3
Aranguren, J. L.
Human Communication

4
Frank, Lawrence K.
in Kepes, G.
Sign, Image, Symbol

5
Cassirer, Ernst
from Frank, Lawrence K.
in Kepes, G.
Sign, Image, Symbol

6
Von Foerster, H.
from Kepes, G.
Sign, Image, Symbol

7
Gelb, I. J.
The Study of Writing

8
ibid

9
ibid

10
Frank, Lawrence K.
in Kepes, G.
Sign, Image, Symbol

11
Read, Herbert
Icon and Idea

12
ibid

13
ibid

14
ibid

15
ibid

16
ibid

17
Gregory, R. L.
The Intelligent Eye

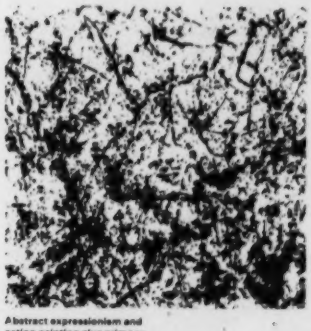
18
Gelb, I. A.
The Study of Writing

20
ibid

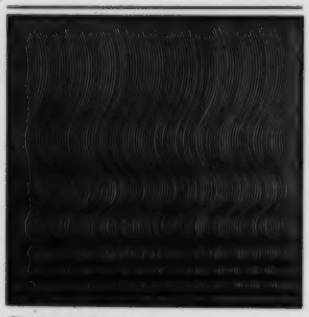
21
Mueller Brockman
History of Visual Communication

22
ibid

Objects may be represented by ideal forms, or in a manner based on ideal forms.



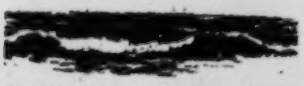
Abstract expressionism and action painting give primacy to expressive information content from emotional experiences and impulses to body movement, resulting in graphic gestures.



'Non-representational' images exist without any reference to anything else; therefore, semantic information is minimal or absent and syntactic information is the predominant concern.

Abstraction stems from the limitation of channel capacities. We only use a small portion of the information that comes through our senses. Omitting some information maximizes the likelihood that the information deemed most important by the image-maker will be received and processed.

Moderate abstraction may be said to be a compromise between semantic and syntactic information, where the syntactic information emphasizes or clarifies certain features or attributes of the referent.



Distortion involves discrepancies between the representation of a subject and the properties it actually possesses. That is, the image-maker may express an idea or concept by modifying the semantic information of the subject itself.

A distorted representation can be fully specified so that it contains no 'abstraction' in the sense that the image may appear with a high degree of iconicity.

Surrealism carries distortion of semantic information to its limits, by presenting objects and events, or combinations of objects and events, that do not and could not exist. In reality. But it usually presents them in full and vivid detail.

1
Berlyne, D. E.
Aesthetics and Psychobiology

2
Taylor, J. A.
from D. A. W. I.
Visual Communication

3 4
Berlyne, D. E.
Aesthetics and Psychobiology

Perceiving

Organisms survive by responding in an optimal way to their environment. At any moment a higher organism can behave or act in a variety of ways; however, one or perhaps a few of these actions will be optimal for the organism's well-being. Survival through biological adaptation depends upon as close a correlation as possible between actual responses to the environment and those that would be optimal. In other words, there must be some information transmission between the sample space of optimal responses and the sample space of actual responses. Information from the optimal response space is conveyed through events inside the organism and events in the organism's immediate environment. Stimuli from the environment are perceived as information in the brain, which may then signal muscles and glands accordingly.

At biologically higher levels, the choice of stimuli and the reactions to them are increasingly controlled by the individual.

Animals, and especially higher mammals, spend much of their time performing actions that have no purpose other than bringing their sense organs into contact with particular stimuli. They are in effect selecting their own stimulus or experience situations. This forms what is called *exploratory behavior*.

Animals seek out stimuli whose information content is useful in guiding subsequent acts with biologically valuable consequences. Animals may also seek access to information that is not used to guide subsequent action, but is gained for its own sake.

Exploratory behavior may occur as a result of uncertainty experienced because of a lack of information about an object or event, possibly because it is novel or because perceiving may take place under unfavorable conditions. Such behavior as the result of uncertainty may be termed *perceptual curiosity*.

Uncertainty and conflict of information appear to intensify arousal. Seeking out further information in order to reduce the uncertainty of a specific object or event (arousal reduction) is termed *specific exploration*. However, animals, through *diverse exploration*, may seek out stimulation for its own sake as a result of boredom rather than of curiosity.

There are two characteristic problems in gathering information that beset all organisms:

1. The information available in the present stimulus situation may be insufficient. The consequences of behavior may well depend on distant or future events that are not reflected in the present situation. One way this difficulty may be overcome is to move to another location where some of the necessary information is available, though it is always necessary to combine or interpret new 'input' information with information (knowledge) stored inside due to heredity or previous learning.

2. Much of the stimulus information from the environment is discarded. This is due to:

   (a) limited channel and information processing capacity

   (b) the information being irrelevant to selecting optimal adaptive behavior.

Perceptual development is primarily a matter of perceiving objects and events in terms of larger sets or bundles of features. In any specific situation, the beginning of a search for the distinguishing features of an object is the awareness of uncertainty. Features are then sought which will reduce that uncertainty, and the search ends when the uncertainty is reduced to an acceptable level.

In perception, cues are not selected simply because they differentiate objects in the environment; the cues that are selected are those which differentiate alternatives in the context of performatory acts. In other words, cues are not noticed as objective differences between stimuli, but as information for the guidance of a performatory act.

Different perceptual information is involved in the acts of perceiving and performing. In order to 'perceive' in the context of a set of static forms, it is necessary to detect the feature or features which will differentiate the alternatives in the set. In performing, it is necessary to have the guidance of each component of the act for selecting between all the possible alternatives at each point in its performance. Each type of performatory activity requires for its guidance different perceptual information.

One's picture of the world is coded in terms of the actions one performs. It has been agreed that activity yields two types of information: information about the world (knowledge) and information about the activity itself (skill or ability). Knowledge (knowing that) reflects the natural and social environment, while skills (knowing how) reflect the nature of the activity.

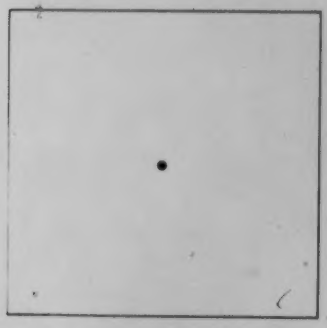
Human eyes feed the brain with relatively 'undoctored' information which is then organized by internal processes. In comparison, animals with simpler brains have a smaller capacity to process information, but have more elaborate mechanisms in the eye which filter out information that is not essential to their survival. The complexity of the human brain allows it to make new inferences from sensory data which enables us to assimilate and use much more information than other animals. Memories of past experiences stored in the brain and anticipation of future events help to determine interpretations of sensory information by allowing our perceptual system to suggest and test hypotheses in a search for the best interpretation. The great advantage of an active perceptual system is that it may act on a hypothesis in the absence of reliable information. If our brain was unable to fill in perceptual gaps and form probable hypotheses, we would often be unable to function, or we would function at a simple level, responding only to direct stimuli. Though we we may sometimes be in error, the central levels of our perceptual system give us some freedom from immediate stimuli for determining our behavior.

The basic perceptual process

No stimulus can be reacted to unless it is distinguished in perception.

Noticing the presence of a stimulus is stimulus *detection*. The minimum amount of information required for the detection of a given stimulus is a *threshold*. Within the category of detection, there are tasks that differ in their generality or complexity, and therefore differ in threshold values.

The *absolute threshold* refers to the least amount of energy to which a perceptual system can respond when the stimulus to be detected is without competition from an other stimulus. (This in effect never really happens as the brain is always functioning, and there is never a 'zero' background of neural activity.)



The most general form of detection tasks is a reaction to change: *An immediate response to change seems to be one of the most fundamental properties of the perceptual system; other perceptual processes can be considered as deriving from this very basic response.*

A *difference threshold* refers to the least amount of change that can be detected when the system is already being stimulated by the variable in question.

The perceptual system is not only responsive to change, but also to constancy or equality. *The responses to equality do not necessarily represent merely the failure to notice a change*. Unexpected sameness can be as compelling and shocking as differences or change. For example, the similar appearance of twins is often surprising.

It is possible to notice or perceive change without being aware of the nature of the change. To specify attributes on which change has occurred is a perceptual task requiring much more information than that of simple detection and, correspondingly, the threshold for the detection of a change in a specific attribute is generally higher than in a simple detection task.

Behavior is not only based on detection of a stimulus, but is often based on relations of stimuli. Perceptual activity in these cases involves comparison.

Sometimes comparison occurs among elements that are simultaneously present. If one stimulus is distinguished from the others due to some specified attribute, there is *recognition*. At other times, a given stimulus may be compared with stimuli that have been present in the past but which are now only memory traces, or information represented as knowledge in the nervous system. This process of recognition with unspecified alternatives is *identification*.

In image recognition, the enclosing contour generally carries a significant part of the necessary information.

Some of the main aspects of comparison in recognition and identification are:

Existence and extent of difference

Some responses depend upon the difference of a present stimulus from those of the past. These differences may be compared on the basis of novelty vs. familiarity, or surprisingness vs. expectedness. The intensity of the response usually varies with the amount of difference between the stimulus and past experience or expectations. These responses are notably exploratory or emotional. In a judgement situation, the difference can be determined quantitatively as large or small.

Direction of difference

This is a response to ordering relations that consists of determining whether a stimulus has more or less of a particular property than another.

Direction in extent of difference

Behavior will, in many instances, be determined by the ability to distinguish a quantitative difference in direction, such as 'much bigger', 'a little longer', etc. These judgements may be affected by adaptation level. At any specific moment a person possesses an adaptation level with respect to a particular stimulus attribute as the result of past (especially recent past) experiences. For example, a dark and cloudy day may seem 'bright' after spending a length of time in a dark building such as a movie theatre.

Complexity is determined by the existence, extent and direction among its simultaneously present elements as well as other responses (including emotional and explanatory responses).

Decentering

As visual perception is subject to illusion, and since only a relatively small part of the visual field is at optimal clarity (due to various physiological factors), a number of successive and different glances at an object, from different viewpoints and with different points of fixation, minimizes distortion in comparing and collating stimuli.

Aspects of perception

1. *Perception is gradual and requires time*

The process of perception (microgenesis) evolves over time through three general phases:

(a) *the diffusion phase*
In this initial phase the subject simply sees that something is there. The visual image is inarticulate and undifferentiated.

(b) *the differential phase*
In this phase elements, the generic quantities of attributes, become apparent. The subject recognises a particular class of object without being able to identify all its details. The relationships between the elements remain unclear.

(c) *the integration phase*
The final phase of the perceptual process occurs when the perception is complete and the elements are clearly apprehended as a coherent whole.

2. *Perception involves effort and difficulty*

The effort and difficulty of perception is greater at the initial stage of the process than at the end. Difficulty, and therefore effort, increases with the degree of initial uncertainty about a pattern. It is therefore more difficult to perceive complex, novel or ambiguous patterns. The term 'difficulty' means that the process of perception of a particular stimulus must compete with other interfering response tendencies and processes occurring within and external to the subject, and is thus subject to error or incompletion. Thus it is more difficult to perceive complex, novel or ambiguous patterns. A high level of activity due to a considerable degree of effort will produce conditions of moderate arousal in order to eliminate the uncertainty of a perception. When suddenly all the elements of a problem are resolved, we experience 'insight'.

3. *Perception involves motivational responses and emotions*

The process of perception is determined by behavioral as well as structural factors. Behavioral or motivational factors such as needs, drives, values (social, political, religious, aesthetic, etc.), tensions, interests, expectancies, defenses, emotions, past experience (memory traces) will affect what is perceived. These factors may be of a temporary nature or form a stable condition known as 'personality'.

Experiments have shown that needs like thirst and hunger influence perception, and the value which an individual attaches to an object influences the perceived magnitude (the same coin appears larger to poor children than it does to rich children). A mail box may go unnoticed until we wish to mail a letter.

We not only believe what we see; to some extent we see what we believe.

It seems that we are so used to seeing rectangular rooms that we accept the shape of this experimental room as being rectangular and are willing to accept the large variance in human size. However, experiments show that wives see their husbands as being a normal size and the room in its true queer shape.

We must perceive in order to understand. On this basis, *a work of art exists only insofar as it is perceived . . . and for the same reason it is susceptible to being decoded and interpreted in completely different ways.*

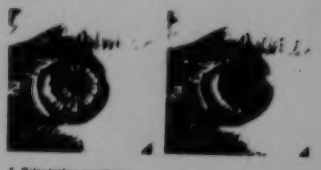
All forms of communication are predictive and anticipatory. Due to his past experience, the viewer of a work may have certain expectations or semantic values for art.

In interpreting a work, he anticipates a high probability of determinacy based on these values: *The less information a work of art has to offer--that is to say, the less new it is--the more easily and therefore more readily it is accepted by the masses . . . .*

If the viewer cannot readily perceive his own established values in a work of art, the alternatives of interpretation become greater than he expected. A certain level of unexpected indeterminacy may prove intolerable to the viewer, at which point he may take recourse to the statement, 'What is it?' His expectations have interfered with his understanding.

Most perceptual activities involve motivational effects such as emotional impact. The exceptions are innate or learned reflex responses that are so automatic that the subject is not even aware of the stimulus or the response. Other exceptions are *stimuli that have been repeated several times in a short interval without biologically important accompaniments and stimuli from which attention is deflected.*

Most perceptual responses to stimuli fall into two categories:



1. *Orientation reactions*

These are a complex of psychological and physiological processes, usually lasting a few seconds after stimulation, that increase the capacity to take in information regarding a particular stimulus. Included in these reactions are receptor adjusting and exploratory responses, as well as photochemical changes to increase sensitivity.

2. *Defensive reactions*

In general, these reactions tend to reduce sensitivity to protect against stressful stimuli.

4. *Perception can be rewarding and pleasurable*

Because perception may be difficult and require effort, it can produce high levels of arousal. When uncertainty is eliminated the subsequent relief is often pleasurable and rewarding. The continued viewing of a stimulus pattern may in turn produce moderate levels of uncertainty and subsequent reductions which maintain a viewer's interest.

5. *Perception results in mediating responses*
Mediating responses take place when an object or event is perceived. These are the processes that 'make sense of' the perception, 'organizing' it, 'analyzing' it, 'structuring' it, allowing us to understand it. Thus, mediating responses provide information as guidance for action; this is their original biological role, although the information may not always be utilized.

Each stimulus often, if not always, evokes two or more responses in turn. The initial or mediating response to a stimulus, like all responses, produces feedback information. This feedback, in relation to the stimulus, provides guidance in determining what the organism will do next.

The mediating response may occur solely because of the supplementary guidance it gives to further behavior, and can perform this function as well as, if not better than, an implicit or internal form. Mediating responses often, but not always, qualify as symbolic responses; that is, they correspond or refer to some inaccessible object or event of significance for any further action an individual may take. Most mediating responses are learned: *In human life, the mediator that supplies vital information is often reached as the final link in a chain of symbolic responses, so that we may describe it as a product of* thinking. *Sometimes it can be traced back to two or more distinct learning experiences, so that it is a product of* reasoning. *If as usually is the case it fulfills both of these conditions, it is a product of* direct thinking.

Emotional responses

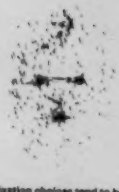
Some stimuli are innately frightening, painful, or joyful; they create emotional responses that bias subsequent behavior. Stimuli can evoke conditioned or learned emotional responses because in the past they have accompanied stimuli with emotional effects. Emotional responses are produced by resemblances between a new stimulus and others, previously encountered, which had an emotional impact.

Motor responses

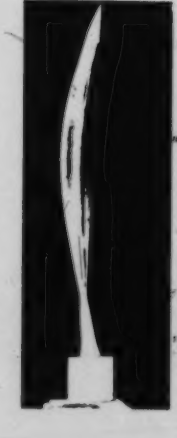
The feedback stimulation resulting from body movements or internal motor responses that serve as pure stimulus acts without overt action are sources of mediation. It is thus possible to appreciate tactile qualities by viewing a textured surface or smooth contour because of the ability of motor responses to facilitate the apprehension of objects.

[1] *. . . all of our perceptions are dependent upon motor attitudes that are assumed towards the object . . . when we notice the smooth curves of a marble torso we can probably, if we observe carefully, get a fleeting image of our hands moving in imagination around the figure.*

There are also manual 'receptor-adjusting' responses that allow us to explore the features of an object. The integration of single glances of the eye form a schematic map or construction of the shape of an examined object.



Fixation choices tend to be primarily confined to high information parts of a picture, as the eye appears to search for unusual, complex, or unpredictable aspects.

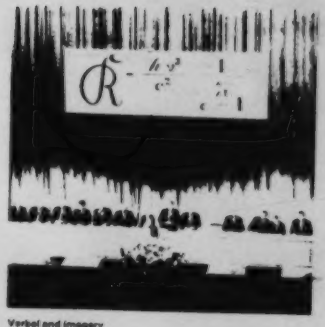


Imitative responses and empathy

[2] *Several writers have maintained that not only moving human beings and animals or even moving inanimate objects, but even stationary objects can elicit imitation, especially in an implicit form.*

[10] *Empathy is usually characterized as a process projecting emotional and other reactions onto an external object, such as a work of art, so that the object seems to embody or express human feelings.*

Empathic responses can be conceived as tendencies to internal movement suggested by perceptive properties (especially spatial properties) of objects. Empathy is not 'imagined movement', or 'sensation of movement', but the feeling of willing, of inner effort or exertion, of attainment, in short of inner doing.



Verbal and imagery responses

Even when dealing with direct action and experience, *our behavior appears to be through internal symbol systems.* The mediating role of verbal labels and comments and images allow man to abstract, to symbolize, to think and reason through their internal representation. In short, they are the tools of intellect that distinguish man from all other organisms.

1 Arnheim, R. *Art and Visual Perception*

2 Dember, William *The Psychology of Perception*

3 *Ibid*

4 Aranguren, J. L. *Human Communication*

5 *Ibid*

6 Berlyne, D. E. *Psychobiology*

7 *Ibid*

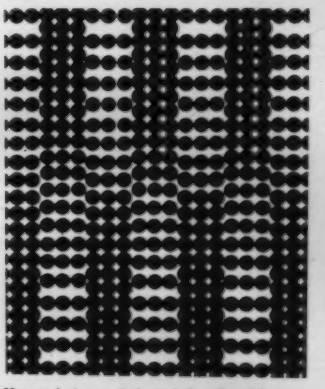
8 Langfeld, H. S. *The Aesthetic Attitude*

9 Berlyne, D. E. *Aesthetics and Psychobiology*

10 *Ibid*

11 Lipps, T. from Berlyne, D. E. *Aesthetics and Psychobiology*

A Visual Syntax



Human beings gain knowledge through direct perception of their environment and through indirect perception using communication by 'signs'. The visual image is a sign, and as such mediates our knowledge of the world.

The meaning of an image, its recognised significance by a viewer, is largely based on the organization and relationship of its component elements, that is, its form. Form is the perceptual carrier of meaning. A visual image is an 'idea in form'.

In verbal language the structure of the sentence, the relationships of the words, will help to determine its effectiveness as a communication. In considering images as visual communication, there are no equivalent structural rules, other than those of perceptual organization.

The *Gestalt* school of psychology was primarily concerned with aspects of organization with which the term 'Gestalt' is practically synonymous.

According to the theories of Gestalt psychology, the fundamental unit of perception is not a single stimulus, but rather patterns of stimuli, each consisting of a collection of elements in a particular arrangement. Perception is based on the total configuration of the outside world as it is interpreted by the individual. It is therefore dependent upon the elements as well as their context, that is, their relationship to one another within the visual field. Our interpretation of size, movement, depth and distance of material objects depends upon the nature of the context in which they are perceived.

No stimulus is seen irrespective of its surroundings. Beyond relative size (scale) and position of elements in the visual field, there exists a structure of perceptual 'forces'. Seeing something means assigning it a location within that structure.

If a circle is placed within a square so that its centre is close to but does not coincide with the centre of the square, the circle is seen as being attracted to the centre of the square as that their centres coincide. If the circle is placed towards the border of one edge of the square, it may tend to be attracted to that edge. If the circle is

placed in various positions within the square, it may be found that at certain locations it appears stable, in dynamic equilibrium with the square, and at other locations it experiences 'pulls' in definite directions, or its position may be unclear and wavering.

Briefly stated, wherever an element is located in the visual field, it will be affected by the structural forces existing in that field.

Psychologically, these forces exist for everyone in every perception and are as real as the objects themselves. Visual forces act as the physicist's vectors, for they have a point of attack, an intensity and a direction, and therefore follow the laws of physical forces. As with physical forces, their properties are determined by the size, weight, mass or relative position, etc. of the elements concerned, and thus can be balanced in a visually analogous manner.

Perceptual forces create the structure that enables us to see objects in a myriad of visual stimuli. It is the means through which we are able to integrate stimuli.

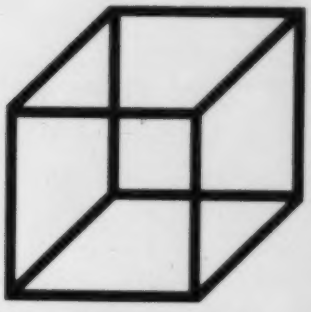
Seeing means grasping a few outstanding features of the object . . . A few simple lines and dots are readily accepted as 'a face', not only by civilized Westerners, who may be suspected of having agreed among each other on such 'sign language', but also by babies, savages and animals . . . Vision involves the solution of a problem—namely the creation of an organized whole.

Overall structural features are the primary data of perception. 'Chairness' is not a concept resulting from intellectual abstraction, but is the direct result of a more fundamental perceptual experience than the recording of individual details. Thus all the variety and styles of chairs are recognized as such because they all have the underlying structural features of a 'chair'. A child will see a chair before he can recognize it as a particular style of chair distinguishable from others.

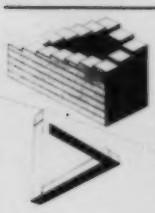
Structure refers to the distribution of materials in space. The structures of objects form shapes and involve such spatial aspects as the boundaries of masses by surfaces, and the boundaries of surfaces by borders such as lines. The most accurate way of describing the spatial features that represent a shape would be to determine all the spatial locations of all the points that make up these features. However, in perception the eye grasps shape immediately by seizing upon the overall laws of construction based on distinguishing facets and the underlying structure of perceptual features.

The perception of shape, then, is the grasping of structural features found in and imposed upon the stimulus pattern. In order to account for the complexity and flexibility of shape perception, we must assume that the decisive operations of perception are accomplished by processes in the brain which organize the stimulus material on its arrival. Rudolf Arnheim suggests that *the stimulus configuration seems to enter the perceptual process only in the sense that it evokes in the brain a specific pattern of general sensory categories, which 'stand for' the stimulation in a way similar to that in which in a scientific description, a network of general concepts is offered as an equivalent of a phenomenon of reality.*

There must, however, be a basis or criteria for organizing stimulus patterns. Why are these four dots perceived as a square and not a circle or as a variety of other shapes? The answer lies in the principle of simplicity. The Gestalt psychologists particularly stressed the tendency for the perceptual system to group things into simple units. This principle demands that when several hypotheses fit the facts, the simplest should be chosen. According to Cohen and Nagel, *one hypothesis is said to be simpler than another if the number of independent types of elements in the first is smaller than the second.* In terms of information theory, preference is given to the smallest sample space. This forms a basic law of visual perception which asserts that *any stimulus pattern tends to be seen in such a way that the resulting structure is as simple as the given conditions permit. In a relative sense, a thing has simplicity when it organizes complex material with the smallest possible number of structural features.* The perceptual result of any stimulus pattern *is determined by the structure of the stimulus in its interaction with the striving for the greatest simplicity* . . . . That is, the perceived pattern will be the one that combines the conditions of the retinal stimulus and the organizational tendencies of the brain in the simplest possible structure.



Here the sensory information is constant, and yet its perception changes from moment to moment, as each possible hypothesis comes up for testing.



In an effort to achieve the greatest simplicity, complex visual patterns may be organized in terms of their parts. Pictures can appear paradoxical when the observer happens to organize parts of the same object in conflicting ways, or selects an inappropriate perceptual hypothesis for interpreting the picture in terms of the principles of economy (through which he perceives everyday objects).

In drawing, there is a tendency to reduce the number of structural features of a given subject. However, this tendency does not always manifest itself in the simplest visible structure. Balance is simpler than unbalance, symmetry is simpler than asymmetry. When individuals are asked to copy from memory a stimulus figure which deviates slightly from symmetrical balance, the responses will take two forms:

1. *Leveling*

   Some persons perfect the symmetry by eliminating any differences the stimulus figure has with a 'good' configuration.

2. *Sharpening*

   Other individuals will exaggerate the asymmetry, showing clear dominance of one structural feature.

In both cases, elimination of ambiguity enhances simplification.

Stimulus patterns are sometimes related to the shape of objects the observer knows from previous experience. By adapting new perceptual stimuli to existing memory traces, the viewer always simplifies his total memory structure. Therefore, adaptation of new experiences to those of the past is in keeping with the general law of simplicity. In a complex perception, an individual may introduce entirely new and personal elements due to previous associations with certain stimuli. Leveling is characterized by such factors as symmetry, repetition, unification, omission of details, omission of obliqueness.

Sharpening is characterized by subdivision, emphasis of differences, stressing of obliqueness. Sharpening involves simplification when it helps to eliminate ambiguity, but not in other examples where it occurs although no ambiguity is involved. In such cases sharpening is used for exaggeration or emphasis.

Perceptual organization consists of grouping stimulus elements together to form a pattern which will evoke a response. Perception is an effort to impose order on the stimuli that we detect, by seeking the simplest alternative in any given situation. From the initial mass of stimuli that bombard the eye, various elements begin to stand out, separate from others, and spontaneously form units which we perceive as objects in the environment.

Stimulus patterns are organized according to the principles of visual grouping. In a general way, figures are grouped together so that the 'best', that is the simplest, organization is achieved.

According to Gestalt psychologists, there are three essential lessons to be learned from their research in perception:

1. The tendency to group perceptual elements is universal and irresistable.

2. If no single pattern can be perceived as the simplest figure, elements are invariably grouped in several ways.

3. Generally, certain groupings are much more likely than others. Patterns in which several alternative groupings co-exist are exceptional.

Visual elements may be grouped in two general ways:

1. Certain elements may form a unit, although each of them maintains its own individual identity.

2. Certain elements may form a unit which is so strong perceptually that the individual elements are not apparent.

Classical Gestalt theorists developed organizational 'laws' or principles to describe the grouping of elements. With qualifications these principles are still generally applicable.

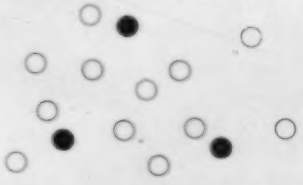
Generally, the grouping of elements is based on the five following principles:

1. *Proximity*

With all other factors constant, groups tend to be formed from parts which are spatially close to each other.

2. *Similarity*

With all other factors constant, organization is determined by the common features elements possess.

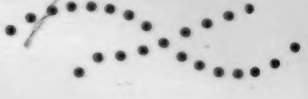


3. *Common movement (common fate)*

With all other factors constant, objects which move in a similar way are related to each other and may therefore be 'bound' together as a group.

4. *Good continuation*

Elements are grouped according to the continuity of relationships between one another so that they form a contour or consistent shape. Such a set of elements will determine to a large extent the way in which additional elements will be organized. That is, additional elements will tend to continue the intrinsic structure of the grouping. *The more consistent the shape of a unit, the more readily it will detach itself from its environment.*



5. *Closure*

Elements are grouped so that perception is complete in its simplest form. There is, therefore, a tendency to closure of unclosed configurations which facilitates a simpler perception. A closed figure is usually seen as a separate and complete unit.

These factors, according to Gestalt theory, are determined by innate properties of the nervous system. There is, however, some evidence that would indicate that learning plays some part.

The Gestalt principles are of historical import in pointing out the tendency for elements to be perceived as organized patterns or 'wholes'. These organizational 'laws' have provided a framework for recent developments in the quantitative aspects of organizational processes using the nativistic or 'inborn' interpretations of visual organization, and have also provided material to be tested (and sometimes refuted) by the empiricists (those theorists who believe all behavior is the product of learning or experience).

In recent years it has become clear that our understanding of the perception of figures could not progress past the descriptive Gestalt laws without quantification of some aspects of figures. Theorists of the nativistic approach have provided an analysis of stimulus qualities by considering perception as an 'information-handling or processing system'. It has been noted that *much information perceived by the organism is redundant* and that *sensory events are interdependent in space and time . . . Thus, if we know the state of a number of receptors at some point in time, we can make better than chance inferences about higher states and subsequent states.*

. . . perception might be conceived of as a set of preliminary 'data-reduction' operations, whereby sensory information is described or encoded, in a form more economical than that in which it impinges on the receptors. Several theorists have described the gestalt organizational principles in these terms.

At the other extreme, the empiricists believe that stimulus projections on the retina are not solely adequate in explaining our perception of the world. They believe that perception relies on additional factors including memory, learning, and personality. In empiricist theory, *the visual perception of space must emerge in part from the information provided by features of the stimulus on the retina.* Therefore, empiricists have shought such features within the two dimensional pattern on the retina which may be used in conjunction with past experience to determine the perceptual outcome of any given moment. These features have been called 'cues', or sometimes 'clues', to incorporate in their name the notion that they do not uniquely determine perceptual experience in and of themselves.

Additionally, R. L. Gregory states:
The seeing of objects involves many sources of information beyond those meeting the eye when we look at an object. It generally involves knowledge of the object derived from previous experience, and this experience is not limited to vision but may include the other senses; touch, taste, smell, hearing and perhaps also temperature or pain. Objects are far more than patterns of stimulation: objects have pasts and futures; when we know its past or can guess its future, an object transcends experience and becomes an embodiment of knowledge and expectation without which life of even the simplest kind is impossible.

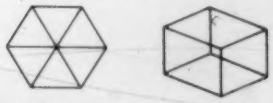
Certainly what we know will to some extent determine what we see. For example, certain stimulus patterns are grouped on the basis of our knowledge and not by following the 'rules' of perception.

Gestalt psychologists *thought of perception in terms of modifications of electrical fields of the brain, these fields copying the form of perceived objects.* However, there is no independent evidence for such brain fields; therefore, this theory is highly questionable.

More recently, some psychologists have treated perception as an *information-handling or processing system, noting that much information perceived by an organism is redundant*, that is, portions of the field are highly predictable based on information from other portions of the field. *Redundancy results both from an area of homogeneous color or brightness, and from a contour of homogeneous direction or slope. Thus one may suggest that information or uncertainty is concentrated along contours--regions where color changes abruptly--and at those points in the contour at which its own direction changes most rapidly--at angles or peaks of curvature.*

There is also redundancy in patterns. *Many of the Gestalt principles of perceptual organization pertain essentially to the distribution of information in a picture.* The Gestalt laws of grouping, such as similarity, proximity and common fate, all refer to the organization of visual elements that reduces uncertainty. The perceptual system *groups those portions of the input which share the same information . . . of all possible organizations, the most probable perceptual result is one which involves the least amount of information, that is, the greatest redundancy.*

This same approach may be applied to the perception of simple line drawings which appear as representations of three dimensional figures.



When simple symmetry is achievable in two dimensions we shall see a plane figure. If it requires three dimensions we shall see a solid.

Generalizing, surface patterns will tend to look three dimensional rather than two dimensional when it allows for a simpler perception, that is, when there is greater redundancy.

In order to get the simplest or 'best' perception, elements are formed into stable groups; the principles of perceptual grouping prevail over complex and unfinished organization. In perception there is always an effort to achieve stability over variability. To a large extent our perception of the world would be confusing if the objects in it did not remain reliable and predictable under various conditions. Therefore, perceptual stability is adaptive and desirable.

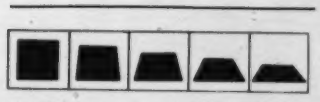
Differences which occur in the characteristics of objects such as size and shape tend to be perceptually minimized. Therefore, there is a tendency to see an object as being the same, regardless of our viewing angle, our distance from it, and the surroundings in which we see it. This is termed 'perceptual constancy' and forms an important basis in dealing successfully with the variabilities of our environment as a result of spatial and temporal changes.

If an artist employs a geometrical perspective, he is not drawing what he 'sees', but rather is representing his retinal image as a camera records a picture on film. This kind of drawing or photographic image does not allow for perceptual factors such as scaling constancy and thus distant objects tend to appear 'too small'. Due to scaling constancy, for example, artists' depictions of the moon are often over-represented in size; in a photograph of a night landscape the moon will appear to be 'too small' as there is no compensating constancy effect.

The effort of our perceptual system to constancy scaling (the tendency to compensate for changes in the retinal image with viewing distance) may result in optical distortion. That is, if an object appears farther away than another object of the same physical size, the perceptual system will tend to increase the size f the more distant object.

If two lines are in fact the same length on a two dimensional surface, a perceptual cue, such as converging lines (which make one object seem farther away than the other) may trigger the constancy effect. The result is that one line is apparently longer than the other.

Constancy of shape is another example. A partially opened door produces a trapezoidal image on the retina due to foreshortening. However, we do not suppose that the door has changed shape, rather we see a rectangle that has apparently been distorted by a change in its orientation.



There will be a correspondence of shape between what exists and what is seen, as long as the perception of the image is that of a distorted, simpler figure.

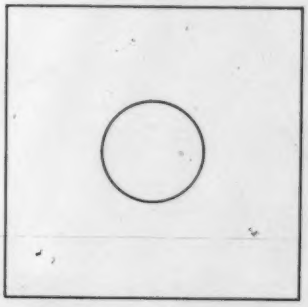
Thus, a trapezoid is perceived as a square slanting in space and is a cue for depth perception. When the shape of objects is irregular, however, their projections may not look like distorted, simpler figures, and constancy of shape breaks down. Three dimensionality must then rely on other factors.

The constancies and the other processes of perceptual organization can be thought of as providing the necessary stability within which the individual can behave and within which variety can be discriminated and appreciated.

Perception gives priority to what is striking. A pattern that is vivid, novel or has a centred position will be selected for attention because it stands out against the rest of the visual field. No differentiation of an object from its background is possible in an environment that is homogeneous. As applied to images, this principle gives rise to a figure-ground relationship; that is, when experiencing an object, we are first aware of a figure which is distinct from the surrounding background or visual field. This is fundamental to the perception of all objects. Distinctions between figure and ground depend upon our tendency to identify figures by borders, edges and shape. The ground appears relatively undistinguished and tends to extend behind the figure.

The simplest example of this principle is to observe a line drawn on a piece of paper. The line does not seem to be in the plane of the paper, but rather on top of it. The empty paper does not border the line, but appears to continue under it without interruption. If the line were seen as lying within the plane of the paper, the surface would be interrupted. The line might also be seen as the result of part of the surface of the paper being cut away, revealing blackness underneath. By seeing the line above the paper, our perception assumes the simplest structure. An unbroken surface is simpler than a broken one. Thus, the integrity of the surface is maintained. As a result of this, there is a sense of depth and the line appears closer than the ground.

An outline figure formed by an enclosed contour also appears above the ground. The inside of an enclosed contour tends to be more visually dense, suggesting matter, while the outside area seems loose and penetrable, like vacant space. Perceptually, the enclosed area and its surrounding area are dissimilar. The result, then, is not a linear ring hovering above the ground, but rather a disc like figure. Enclosed surfaces tend to become figures, whereas the enclosing surface becomes ground.



Probably the most fundamental technique for producing a reliable segregation of materials is through the contrast of opposing elements. A line or an area is distinguished from its surroundings by differences in brightness and color. The differences between elements determines the boundary between figure and ground.

In general the figure has form or shape, whereas the ground is formless. The ground may have thinglike qualities whereas the ground appears uniform. The figure appears to be nearer than the ground, and the ground appears to be extended unbroken behind the figure, even though all of the ground cannot be seen. Contours appear to belong to the figure and not the ground.

When two parts of a figure are equally distinguished as forms or shapes, the tendency is for the figure and ground to alternate.

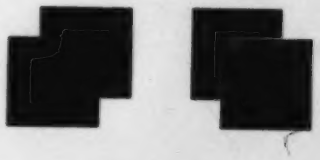
Elements that are seen as figures on a ground are subject to further organization in an effort to simplify perception.

A complex figure may be seen as a combination of other simpler figures. This effect will depend upon the degree of simplicity of the whole as compared with the degree of simplicity of the parts. Thus, greater simplicity of the whole increases unity, as opposed to greater simplicity of the parts which tends to make them appear as separate entities.

The ability to distinguish elements in the environment also serves to indicate depth. Elements may exhibit the following characteristics which act as cues in perceiving depth in three dimensional space. These characteristics may also be used to create spatial qualities two dimensionally.

1. *Overlap or interposition*

The relative distance of two objects may be represented by having one object appear to overlap another, thereby hiding part of the second object which appears farther away.



Thus the two dimensional image is seen spontaneously as two rectangles in space, an overlapping rectangle 'nearer' than another rectangle partially obscured. This would seem to be a perceptually simpler image than that of a rectangle fitting into an 'L' shaped object on the same plane.

2. *Size perspective or proximal size*

As an object of fixed size moves away from the viewer, there is a corresponding decrease in the size of the retinal image. Thus in the abstract composition of a painting, larger elements tend to appear closer than smaller elements in the same visual field. When dealing with recognizable objects, however, our familiarity with their relative size helps to modify our perception, so that although an elephant is bigger than a man, it may not necessarily appear closer.

3. *Linear perspective*

Objects which are parallel in space converge on the retina as they become more distant from the viewer.

Parallel rails converge in the distance because the visual angle separating any pair of parallel points grows smaller with their distance from the eye. As the points get farther and farther from the viewer, the visual angle becomes increasingly smaller; the angle approaches zero as the points move to infinity. If we consider the surface of the Earth a flat plane, it reaches infinity at the horizon, and there are an infinite number of 'vanishing points'.

4. *Texture gradients*

The operation of texture gradients is a special case of proximal size or linear perspective in which elements of these same classes decrease in size and increase in density with distance from the viewer. Thus, coarse texture recedes into a fine texture.

» *The gradient of texture . . . is a function of slant of a physical surface away from the observer and the density of the texture varies with physical distance.*

5. *Proximal brightness*

With all other factors constant, the brighter the object, the closer it appears to the viewer because distant objects appear duller, less chromatic than those in the foreground. The reduction in brightness of distant objects is due to the absorption and diffusion of light by particles in the atmosphere.

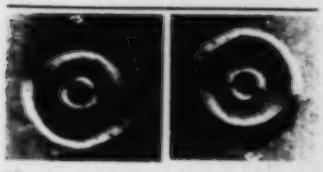
6. *Distortion*

At very close distances objects become distorted through foreshortening.

7. *Light and shade*

» *Variation in shading . . . is a function of the physical orientation of the surface to the light source. It varies not with distance but with the curving or bending of the surface relative to the direction of illumination. Even the slightest curve or bend, insufficient to make much difference in a texture gradient, can produce a variation in shading if the direction of light is favorable.*

Objects are normally illuminated in such a way that the distribution of light is not uniform because of their three dimensionality. Therefore, the distribution of light and shadow can imply three dimensional objects from a two dimensional surface.



» *Because we are so used to having a light source from above, we interpret an element as convex if it has shading in the lower area, and concave if it has shading in the upper area.*

8. *Vertical location in the visual field*

Generally, if an object has a higher position than other objects in the visual field, it will tend to be seen as being farther away. If two circles of identical physical size are placed one above the other, constancy scaling will make the upper circle appear larger as a result of assuming greater distance.

Perception of form will to some extent be affected by its orientation.

The orientation of an object in space is relative to:

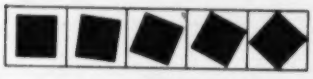
1. its context: the structure of the variant field in which it is perceived

2. the observer's innate capacities: the organizational characteristics of the brain sense the orientation of objects.

> *In sum, the visual cortex appears to have a rich assortment of functions. It rearranges the input . . . in a way that makes lines and contours the most important stimuli. What appears to be a first step in perceptual generalization results from the response of cortical cells to the orientation of a stimulus, apart from its exact retinal position.*

3. the position or orientation of the observer's body with regard to the environment as determined by kinesthetic sensations.

Shapes or coherent patterns will tend to have a structural skeleton or structural axes. When a shape or pattern that has a strong perceptual structure is tilted in space, it will tend to maintain that structure. If, however, the axes of a shape are equal in strength, an actual change of shape may be produced according to our assumed vertical frame of reference.



If we change the structure of the visual field we may restore its original shape and now see it as a square tilted in space. The structure of the rectangle tends to create a frame of reference that argues with the 'upright' axes of the square.

> Generally, we may say that *when several structural skeletons are available, the one that has the simplest relationship to the (dominant) perceptual framework will come to the fore*. Thus, we perceive according to the smallest sample space of alternatives according to the principles of economy and simplicity.

Shapes with an oblique orientation tend to be dynamic and have directionality. Therefore, a diamond with its unstable base is more dynamic than a square, and is perceptually less simple.

A change in orientation may result in apparent movement. Motion is the result of two systems seen as being displaced in relation to one another. Generally, one of these systems is seen as moving or changing while the other appears stable, acting as a field of reference. This relationships tends to be based on a hierarchic relationship of dependence; for example, small is dependent on large, that is, a small object tends to move relative to a large object, a 'figure' moves while the enclosing ground remains stationary.

There are some further aspects of form that are important to the use of visual images as communication.

Forms will vary in the degree of 'articulation' or differentiation that they possess with regard to other forms. A 'good' form is well 'articulated' and therefore tends to impress itself upon the observer, to persist and recur.

> *Gestalt psychologists have insisted . . . that 'good' figures are remembered better than 'poor' ones. If figural goodness is the same as organization, and organization is redundancy, i.e., repetition of the same information, then one may suspect that good figures are remembered better because they contain less independent information.*

Gestalt psychologists have also said that the circle is the 'best' possible figure; it should therefore possess the lowest detection threshold. However, it has been shown that

> for optimal detection performance *a certain amount of stimulation information is necessary, not the least possible amount, which is what the circle represents.*

A strong form tends to be cohesive, thus resisting disintegrating forces, analysis into parts, or fusion with another form.

Once a form is perceived, it tends to persist and to recur when the stimulus situation recurs. If part of a previously perceived form recurs, it will tend to reinstate the whole.

Generally, forms tend to be meaningful to the observer. The more meaningful the form, the stronger it is, the more easily it is perceived, and the longer it tends to persist.

The perception of form will depend on the observer's needs: some will be motivational, while others will be based on the needs of perceptual systems in general. The degree to which these needs or predispositions are met will determine the appeal or memorability of the form, as well as its meaning.

Interesting or appealing forms will tend to include three basic principles based on perceptual needs:

1. they will tend to be balanced, that is, the distribution of visual forces will create a state of homeostasis or equilibrium. Such a distribution may be symmetric or asymmetric, static or dynamic.

2. they will tend to show or express their development through variation and growth. Change or variety will produce added stimuli and moderate degrees of uncertainty which the perceptual system will, by its nature, attempt to resolve. The possibility of gaining more perceptual information will tend to hold the viewer's interest. This principle is expressed through contrast, rhythm, expansion, emphasis, transition, etc.

3. they will tend to maintain their integrity or wholeness. Aspects of formal unity will include harmony, simplicity, congruity, cohesion, order, etc.

These organizational aspects of perception provide the syntax which gives ideas form through visual images.

1
Arnheim, R.
Art and Visual Perception

2, 3
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4
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Eye and Brain

5
Ibid

6
Haber, R.N., Hershenson, M.
The Psychology of Visual Perception

7
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8
Arnheim
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Visual Perception of Form

9
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11, 12, 13, 14
Haber, R.N., Hershenson M.
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18
Gibson, J.J.
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Taylor, I.A.
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Visual Communication

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A Theory of Signs

Semiology deals with the study or science of what are generally termed as 'signs'. In their broadest use, the concepts of sign and symbol may be treated together under this general term. An image may be described as a 'sign' in that it stands for or refers to something else. It acts as a surrogate.

This relationship of 'standing for' involves at least four entities:

1. the *sign*, an object or event which acts as a stimulus
2. the *interpreter*, whose sense organs are stimulated by the sign
3. the *interpretant*, the effect that the sign has on the interpreter; its meaning
4. the *referent* or *significate*, which is the object or event for which the sign stands.

The direct consequence of surrogate or sign making is that another person can apprehend the experiences of the person who made them. That is, one person can transmit knowledge to another. An equally important consequence is that individuals or groups can exchange signs: *This makes possible a common body of perceptions among the group; it influences their direct perception and it may lead to a sort of consensus of experience, a common world in which mediated percepts and direct percepts are no longer separate.*

Signs that are produced intentionally necessarily involve feedback information from the act of sign-making itself as guidance (i.e., a speaker hears the sounds of his voice, an artist sees and guides his pencil movements). As a result, the perceptual process and the sign-making process each tend *to lead into the other and the two become inextricably mixed*. Eventually the sign-making process comes to occur in the absence of the stimulating object to which the original perception was specific: *At this stage of development the individual 'thinks'. Since the same circular operation occurs for other surrogates as well as for vocal ones, it is not unreasonable to suppose that a person can learn to think in terms of drawings or graphs or models (and of the manipulations which produce them), as well as words.*

A stimulus that is a sign for the organism producing it can be called a symbol. A symbol may affect only the originator's behavior. If a symbol is expressed externally, it may act as a stimulus for other organisms. We can say that if a symbol has, at least to some extent, the same meanings for both the source (or originator) and the interpreter, there is some degree of communication.

In the sign or communication process, the interpretant (meaning) is what connects the sign with its referent, and is thus the crux of the process. Meaning can be identified in terms of the response or behavior of the interpreter.

The sign process is said to have three main characteristics:

1. Behavior (response) evoked by a sign is not in general identical with the behavior that would have been evoked by its referent, and it is sometimes very different.

2. When a sign is perceived, there may well be no immediate effect on overt behavior. There may be solely internal effects.
3. The principle effect of a sign on the interpreter often takes the form of a disposition. That is, a state in which a certain kind of overt behavior is likely to occur if a particular situation is encountered in the future.

Information transmitted from the referent (as it is perceived) to the originator (source) may then be transmitted through a sign and result in some behavior by the interpreter.

The medium is generally treated as a stimulation of one or more senses plus informational content. The same medium may be a vehicle for different sign or symbol schemes (radio--language, music) and the same symbol scheme may appear in different media (language--radio, print).

Information transmission through such a procedure qualifies as a 'sign' process if additionally:

1. the sign is an indispensible link through which information from the referent reaches the interpreter.
2. the response of the interpreter is due to the information the sign transmits about the referent or significate.

It is possible to formulate the differences between the visual word and a picture. All signs are specific to their referents, but the correspondence between a word and its object and a picture and its object is not the same.

The word as a sign is specific to its referent solely by agreed-upon convention of language, and bears no similarity to it. At the other extreme, a picture (icon) is specific to its referent through its visual, projective, or replicative similarity.

Both word and picture surrogates may be unspecific or ambiguous in their correspondence to their referents. In the case of pictures, it will be one of greater or lesser *fidelity* (as there is less or more abstraction).

A semiotic or sign approach to the formulation of the difference between pictorial representation and verbal description would be one of *notionality*. Any symbol scheme consists of characters and ways or rules of combining them to create symbols.

Briefly put, a notional system consists of a set of separate discontinuous characters, inscriptions or marks (e.g., a musical score) correlated with a field of reference which is similarly segregated (e.g., sound pitches) so that any character in the system isolates the object it stands for or, conversely, an object isolates the character that it is correlated with. Notionality contrasts with a continuous, unsegregated (e.g., pictorial) system for which no alphabet or set of disjoint characters exists.

Syntactics is the study of the organization, pattern, or construction of characters in relation to one another. To be notional a sign scheme must satisfy two syntactic conditions:

1. it must be *syntactically disjoint*, that is, no inscription can belong to more than one character. This eliminates confusion about the character to which a particular inscription belongs, assuring 'textural identity' (e.g., sameness of spelling across a variety of shapes in spite of differences in handwriting or type style).

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2. it must have *syntactic finite differentiation* (or 'articulateness'); that is, an 'a' inscription of any other shape is still an 'A', with the condition that it must be distinguishable from other marks which are not 'a' inscriptions. Thus alphabets, numbers and musical scores are notational schemes. A scheme may provide for an infinite number of finitely differentiated characters, as in decimal or fractional notation.

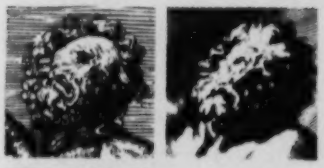
Pictorial systems violate both these requirements as their visual surfaces are not composed of *readily identifiable inscriptions assignable to characters in a notational scheme*. As such, pictures can be described as non-notational.

If we consider only straight lines, we may say that marks differing in length by even the smallest fraction of an inch are stipulated to be different characters. As the difference in line length becomes infinitely small it becomes impossible, even with the most precise measurement, to distinguish between two characters. Thus, there can be no finite differentiation. *On the model of a notational scheme, a system of picturing is* syntactically dense *because it provides for infinitely many characters so ordered that between each two there is a third . . .* such that *. . . no mark can be determined to belong to one rather than to many other characters.*

Semantics deals with the relationships of signs to their referents. Pictures are both syntactically and semantically 'dense'.

MAN

Form is the carrier of meaning. In order to symbolize the concept 'man', we may use the word symbol MAN. To understand the content of the symbol, we must be able to recognize its form. Therefore, each inscription must be recognized as the correct letter; that is, there must be syntactic disjointedness and finite differentiation of inscriptions so that they form the word we recognize as a symbol.



We can also symbolize man with a picture. However, a form that is a recognizable symbol of man can be arrived at through an infinite number and variety of inscriptions.

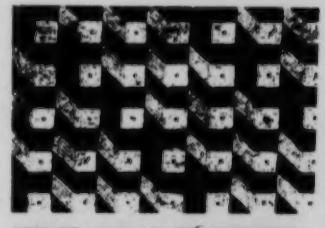
The concepts of a notational scheme as opposed to a non-notational or 'dense' scheme may be considered in terms of digital and analogic codification.

Consider a simple pressure gauge with a circular, unmarked face and a single pointer that moves smoothly in one direction as pressure increases. As the pointer moves, every difference in absolute position constitutes a difference in character, as well as pressure, though the gauge is not using notation in reporting the pressure. *The requirement of syntactic differentiation is not met, for we can never determine the position of the pointer with absolute precision. And since the semantic ordering--of pressures--is also dense, semantic as well as syntactic differentiation is lacking. This gauge may be described as an elementary analog computer.*

We can change the field of reference by considering a counting device such as that used to register traffic over a particular road. As each car passes, there is a corresponding change in a numerical display. This system is clearly notational, as there is a discrete change in character in compliance with each passing car. A scheme which is discontinuous and differentiated throughout is digital.

An ordinary clock consists of both digital and analog schemes. The hour hand is normally used only to pick out one of twelve divisions of a half day, and the minute hand is used only to pick out one of sixty divisions of the hour; the sweep of the second hand, however, is relatively undifferentiated, and we can only approximate the absolute time to the second.

It is possible to make comparisons between symbol systems and the processes utilized by computers. *Digital computers are sometimes said to be capable of complete precision while analog computers can achieve at best only a good approximation. This is true only insofar as the task of the digital computer is counting, while that of the analog computer is registering absolute position on a continuum. The real virtues of digital instruments are those of notational systems: definiteness and repeatability of readings. Analog instruments may offer greater sensitivity and flexibility.*

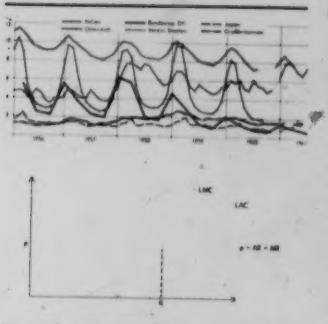


There are examples of pictures where the surface is composed of segregated identifiable inscriptions. A mosaic and a half tone photograph can be seen as a series of bits or compositional units. This form of coding, within itself, appears to be codified in a "digitized" manner. However, we cannot consider the picture as being comprised of a notational scheme.

A code is the elemental unit which describes form; that is, form is the field of reference to which the inscriptions of the code correlate.

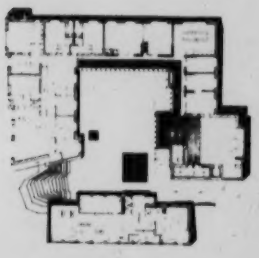
In considering the code of a half tone image, we may have two classes of characteristics: light and dark. Thus, we can classify marks, but we cannot make any finite differentiation between marks in a class. Form may be maintained through the use of a variety of light or dark inscriptions.

Syntactic repleteness differentiates the more representational among semantically dense systems from the more schematic by the number and variety of constituent features. *In a line drawing, for example, all surface features are relevant, whereas in a graph or cross-sectional diagram, the only relevant feature is the exact location of points along a line.*



Diagrams, maps and models may be either digital or analogic. What determines this differentiation is how it is meant to be read. If figures on a graph indicate certain points that a continuous curve passes through, yet every point on the curve is a character with its own denotation, the diagram is purely analogic or graphic.

If the curve on a chart merely joins several numbered points to indicate a trend, the line segments between the points are not characters of the scheme, and the diagram is digital. Scale drawings of buildings are analogic, while most electrical diagrams where the length and shape of lines are irrelevant are digital.

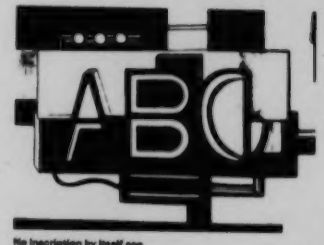


Notational systems are neither better nor worse than non-notational symbols, but rather, they offer different possibilities of representation. No one system is easier to 'read' or learn than the other. Difficulty is a function of complexity, regardless of the symbol system being used.

A practical notation can be devised for any domain that can be digitized--separated into discrete elements. The important consideration is that such digital demarkation should reflect those factors that have been determined as important, that is, determined by its utility value to its users.

10 ***Descriptions are distinguished from depictions not through being more arbitrary, but through belonging to articulate rather than to dense schemes; and words are more conventional than pictures only if conventionality is construed in terms of differentiation rather than of artificiality. Nothing here depends upon the internal structure of a symbol, for what describes in some systems may depict in others. Resemblance disappears as a criterion of representation, and structural similarity as a requirement upon notational or any other languages.***

black red



No inscription by itself can be considered as notational or non-notational. It is the scheme of inscriptions that is notational or non-notational; therefore, the same artifact may participate in different schemes.

1
Barlow, D. E.
Aesthetics and Psychobiology

2
Gibson, J. J.
in Kepes, G.
Sign, Image, Symbol

3
Ibid

4
Gardner, Howard and Perkins
in Olson, David R.
Media and Symbols: The Forms of Expression, Communication and Education

5
Goodman, Nelson
The Languages of Art

6
Ibid

7
Ibid

8
Ibid

9
Gardner, Howard and Perkins
in Olson, David R.
Media and Symbols

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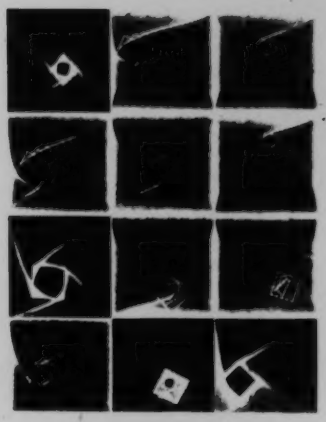
Goodman, Nelson
The Languages of Art

A Theory of Information

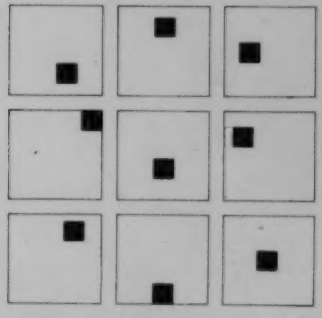


The process of perception is an active search to find distinguishing features in the stimuli that reach our senses. Fundamental to this search is the awareness of uncertainty. Anything that resolves or eliminates uncertainty may be regarded as *information*.

A situation in which some event is to be selected from a set of alternative events (signals) is termed a *sample space*. In such a situation, we do not know which event will occur, but we can enumerate the alternatives and assign a probability of occurrence to them. According to information theory, the probability of a completely determined event is 1.

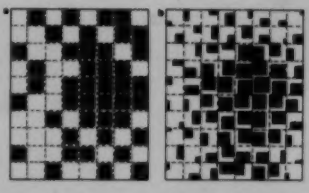
Uncertainty increases with the number of alternatives; if the number of alternatives remains constant, it reaches a maximum when the alternatives are all equally probable.

A central process in the artist's or designer's functioning is the subconscious or conscious exploration of alternatives (that can be regarded as signals). In replete and dense sign systems, search presents a special problem, because the search space is multi-dimensional with many different aspects of the work being significant (replete), these dimensions often consisting of a continuous (dense) range of alternatives. A partial sampling technique may be used to meet this problem by limiting the number of dimensions being searched at one time, and adopting strategies for searching a continuum of possibilities.



Uncertainty is usually measured in binary digits (bits) where the code is the simplest possible, with an uncertainty of one-half (heads or tails).

Thus the information that may be obtained from the determinacy of an event ranges from 0, if its probability is completely determined (that is, there is no uncertainty), to infinity, as the choice of possible events becomes very large.



If there are a great many alternatives, the determinacy of one of them gives much more information than the determinacy of one among only two alternatives.

The transmission of information

There are processes in organisms which are affected by stimuli from the environment (input) and in turn help to determine organisms' responses (output). Biological adaptation requires a maximum degree of correspondence (i.e., maximum information transmission) between the actual response of an organism in a particular situation and the optimal response that would have the most beneficial consequences.

Therefore, we may have a sample space (X) of possible stimuli in the environment, and a a sample space (Y) of possible responses of an organism. Information can be described in terms of what is new in sample space Y in relation to sample space X. This involves transmission of information from one sample space to another; that is, the degree of uncertainty regarding one situation is reduced when one knows which alternatives have occurred or have been utilized in another. The amount by which uncertainty about Y is reduced on receipt of a particular signal belonging to X determines the actual amount of information transmitted. Knowledge about the environment reduces uncertainty about what the organism will do. Knowledge of what the organism is doing will reduce uncertainty about the kind of stimulus situation that it is confronting.

The external environment of the moment normally contains a great deal of information about the optimal response space, but not always all that is necessary: *So it is desirable for as much as possible of the missing information about the optimal response to reach behavior from other sources. This is usually achieved through internal processes, inherited or learned, which represent (are correlated with, correspond to, transmit information from) past, future, or present events that are out of range of these sense organs*. Signs may act as mediating agents in the transmission of information not directly available to an organism.

There need be no direct causal connection for information to be transmitted from one sample space to another. For example, there may be an indirect causal connection between X and Y through a mediator or medium.

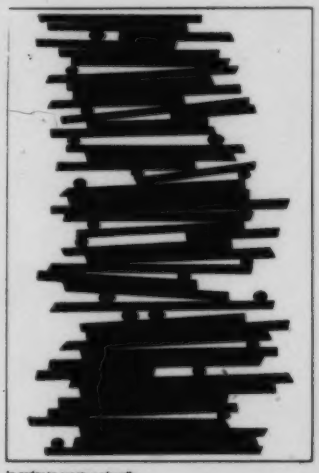
Even though there is no direct physical link between X and Y, it is useful to speak of an information *channel* between them.

Channels have a maximum transmission capacity. If the capacity of a channel is exceeded, information will be lost. In such cases output events will reflect what is happening to some of the inputs but not others, or they will reflect (with some error) what is happening to all of the inputs.

In information theory anything that increases uncertainty is *noise*. Noise occurs not only in the message channel, but also in the encoding and decoding processes as well. *Bits* are used to measure noise so that every time uncertainty is doubled, one *bit* of noise is introduced into the message.

Syntax

An image can be considered as a collection of spatial locations. Each location is occupied by an element selected from a sample space corresponding to that location. When one element is selected for a particular location, it will help to determine the selection of elements at different locations. Information transmitted in this way between elements in the same image is called *syntactic information*.



In order to create a visually balanced composition, each element must depend on the selection and location of all the other elements.

Redundancy

In order to completely eliminate uncertainty, the input must be capable of delivering at least as many messages as there are alternative possibilities in the output.

This condition can be met if the sample space of the input contains as many different signals as there are possible output situations. That is, one signal will identify completely the situation that occurs at the input at any moment.

The sample space of signals is often insufficient to convey the number of messages necessary for the transmission of a message. Consequently, several signals and combinations of signals may be used for each message (i.e., the 26 letters of the alphabet form comparatively large numbers of messages in our language).

Signals may form spatial arrays as in the dots of black and white that comprise a half tone photograph, or in a spatio-temporal array as in film or television.

The transmission of information is the most economical and efficient when the absolute minimum of signals in the output completely eliminates uncertainty in the input. If this condition is not fulfilled, there is some degree of *redundancy*.

All channels of information are subject to some degree of noise. If only the minimum number of signals is being transmitted and one signal is distorted or not received, the input situation cannot be identified at all.

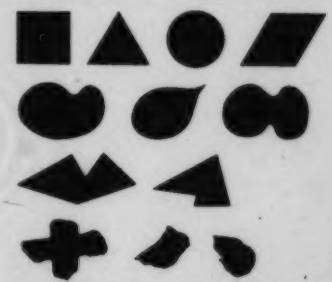
Redundancy is uneconomical; it slows down the process of imparting information; but it provides at least a partial safeguard against information loss or distortion. Along with repetition, it is the only way of correcting errors of reception produced by noise.

There are two types of redundancy:

1. *Distributional redundancy*
   This simply means some of the alternative signals occur more often than others.

2. *Correlational redundancy*
   This redundancy is identifiable with syntactic information. Some combinations of signals occur more frequently than others; therefore, if a particular signal occupies a certain location, certain other signals are more likely than others to occupy other locations. Once the nature of an element in a particular location is known, uncertainty about what will be found in other locations will be reduced. Correlational redundancy, then, is the measure of unambiguous predetermination given by the structure (syntax) of a notational scheme.

Mistakes in common words are easily corrected because of the structure of language and the function of each word in its context. Redundancy (especially correlational redundancy) can be used to quantitatively analyze form in terms of structure, aspects of order, or so-called 'goodness of configuration'. One of the major formulations of the Gestalt school of psychologists is that of 'good' figure which in simple terms states that, *as far as conditions permit, every perception tends to be as complete, symmetrical, balanced or as 'good' as possible.*



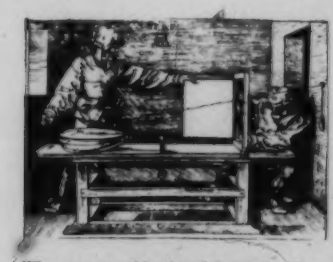
'Goodness' patterns are selected on the basis of the smaller sample space of alternatives or the greater correlational redundancy. For example, the number of possible squares will be smaller than the number of possible rectangles, which in turn will be smaller than the number of irregular quadrilaterals.

Preferences and emotional reactions will be governed by the events the subject represents to himself as possible alternatives and by how likely the subject considers each of these alternatives to be. Thus, subjective assessment of the sample space and its corresponding possibilities form a mental 'set' which will determine reactions.

Informational correspondence

There will be complete information transmission between the input and the output as long as a particular combination of input elements always gives rise to the same output combination and a particular output combination always arises from the same input combination.

This concept of informational correspondence applied to an image is described by J. J. Gibson: *A faithful picture is a delimited surface processed in such a way that it reflects (or transmits) a sheaf of light rays to a given point which is the same as would be the sheaf of rays from the original (subject) to that point.*

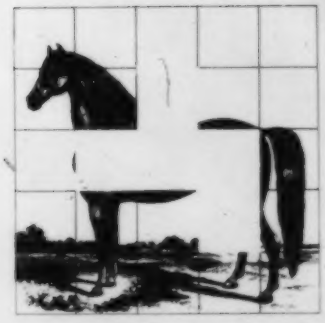


Whenever a combination of elements transmits information that does not exist in any of its component parts acting alone, there is *positive interaction uncertainty*.

There is informational correspondence when positive interaction uncertainty is 0. That is, each output element identifies a corresponding input element, so that the total information of the input is equal to the sum total of the information contents of the separate output elements.

An iconic picture has high informational correspondence with its referent. If a portion of a drawing is lost, we still know what the remaining pieces look like, and we probably have enough information to recognize the whole.

When positive interaction uncertainty is at a maximum, there is no informational correspondence; therefore, it is necessary to have the whole output pattern of signals to be able to identify any input level at all.



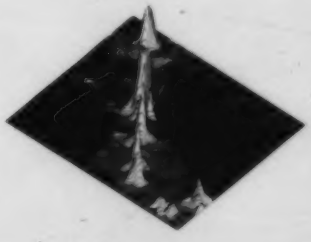
ho se

We know what a house looks like, but *ho* doesn't tell us anything about any part of the house, and *use* doesn't tell us about the remainder. If one part is missing, we have trouble understanding what is being referred to on the basis of what remains; we may even understand the remaining part to mean something quite different.

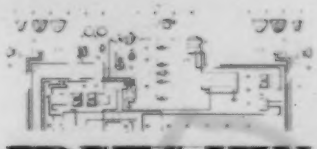
When reading a list of names, as in the telephone book of a particular city, each name identifies a particular member of its population. There is a high informational correspondence.

When images are used to represent countries, the whole image represents the totality of the country with all its attributes. Each part of the image does not specify a particular characteristic of the country. There is a low informational correspondence.

Isomorphism is a correspondence in structure, that is, a correspondence of elements between two sets and a correspondence of relationships between the elements in the two sets. In particular, it is a correspondence between a sign and its referent. Thus, points on a contour map correspond to heights of actual geographical locations. Gestalt psychologists have attached great importance to the correspondence between the form of images and emotional states.



Iconicity is a similarity or correlation in other aspects besides isomorphism. For example, a sign may resemble its referent in color, shape, shading, and so on. A high level of iconicity means a high degree of fidelity and a low level of abstraction.

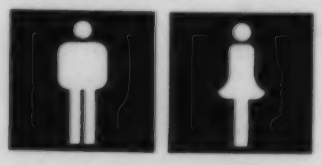


Isomorphism can be present without iconicity as, for example, in diagrams which clarify structural relationships.

Abstraction

Complete transmission of information necessitates a complete specification of a particular object or event, that is, informational correspondence between input and output. Abstraction means incomplete specification. The selection of alternatives may be limited to certain specified properties and therefore inputs that do not have these properties are excluded, while those that do are maintained. Thus, there is only partial transmission of information.

Attributes of an object may be narrowed down to a particular class, but not a specific member of that class, so that the fine differences that distinguish one individual from another are obscured.



Abstraction is also a learned process which enables us to distinguish and recognize objects by revealing something essential to their being. This may be done by abstracting the set of perceptual attributes that distinguish a particular kind of thing from its neighbors. Experimenters have noted that a child must, in fact, ignore or overlook minute details in order to develop perceptual consistency and classification of objects.

Abstraction may be obtained by two means:

1. simply by omitting properties or details or ignoring certain dimensions along which objects differ (i.e., color is absent from black and white drawings or photographic prints)

2. by reducing the number of positions that can be occupied along a particular dimension or set of dimensions (i.e., 'idealization' of forms, or if by convention, 'stylization' of forms.

The Functions of Images

What a picture means to the viewer is strongly dependent on his past experience and knowledge. In this respect, E. H. Gombrich has stated that the visual image goes beyond the mere representation of reality and acts as a symbol. *Use of symbols beyond immediate need is for the sake of understanding; what compels is the urge to know, what delights is discovery.*

Symbolization, then, is to be judged fundamentally by how well it serves the cognitive purpose; by the delicacy of its discriminations and the aptness of its allusions; by the way it works in grasping, exploring, and informing the world; by how it analyzes, sorts, orders, and organizes; by how it participates in the making, manipulation, retention and transformation of knowledge.

Cognition does not exclude the sensory or emotive, that which we know through art is felt in our bones and nerves and muscles as well as grasped by our minds, that all the sensitivity and responsiveness of the organism participates in the invention and interpretation of symbols.

Pictorial images, then, as a symbolic system can be described in terms of their functioning in serving the 'cognitive purpose'.

Pictures are representations.

The representational function is one of denotation. Pictorial representation is the means for making manifest significant relationships inherent in objects; it is a way of classifying objects rather than of imitating them; *it is a symbolic relationship that is relative and variable.*

Representation never produces a replica of the object but its structural equivalent in a given medium. Apart from other reasons, this is true because replication is possible only if the object is duplicated in its own medium.

If we look at the communication process in terms of language, we can determine what differences exist between pictorial representations and words in their capacity for making statements.

Illustrate the statement, 'It might not rain tomorrow'.

Does the picture illustrate the proposition explicitly, or is the verbal statement only one of many possible descriptions that may be applied to it?

Words can be made into statements; pictures cannot. The degree of abstraction necessary for the statement function eludes the visual image.

What, then, are the functions of images?

The informative function

The informative value of an image is its capacity to convey information that cannot be coded as effectively in any other way.

The most obvious advantage an image has is that it depicts.

Why describe something when you can show it?

i·co·sa·he·dral (ī'kō sə hē'drəl), *adj.* having twenty sides.

i·co·sa·he·dron (ī'kō sə hē'drən), *n., pl.* **-drons, -dra** (-drə). *Geometry.* a solid having twenty faces: *Plato was struck by the fact that . . . there is a fifth simple regular solid—the icosahedron* (Scientific American). [< Greek *eikosáedron*, (originally) neuter of *eikosáedros* < *eíkosi* twenty + *hédrā* seat, base]

Icosahedron

i·co·si·tet·ra·he·dron (ī'kō sə tet'rə hē'drən), *n.* a solid figure contained by twenty-four plane faces. [< Greek *eikosi* twenty + *tetra-* four + English *-hedron*, as in *icosahedron*]

Pictures allow us to see things that are not present, to become familiar with things which are difficult to bring into direct view; they acquaint us with imaginable possibilities and they display things that are impossible, but which can be imagined.

Practically speaking, the visual image is the only symbol we have that does not necessarily require the translation of a sensual awareness into terms of some other associated sense awareness or else of some extremely limited, arbitrary, and artificial convention of correspondence.

Visual images, unlike verbal descriptions, address themselves immediately to the same sense organs through which we gather our visual information about the objects they symbolize.

Of course, we may depict or represent in many different ways. However, the interpretation of the image maker must always be matched by the interpretation of the viewer. The 'beholder's share' has been termed by E. H. Gombrich as the contribution we make to any representation based on our own experience, motivation and knowledge.

No image tells its own story.

Reading images

" *There is no one way that things really look, nor any one way that the world really is, rather, the world is as many ways as it can be accurately described. In other words, the fidelity of a symbol system depends upon the accuracy of the information about the world that can be obtained from knowing how to use and understand that system.*

Pictorial as well as verbal images must be 'read'. We must learn which dimensions of an image are relevant.

The chance of correctly reading a visual image is governed by three variables: the code, the caption, and the content.

The code

" Images are symbols: *They stand for, or represent either creations of the imagination or objective paradigms of reality. Whether imaginative (fictive) or reality oriented, these images are, quite literally, what you see on the page. They are the lines, dots, tones, colors--in other words, patterns of ink or other coloring matter--which a graphic medium has somehow deposited on a surface.*

" *Pictures have a double reality. We see both a pattern of marks on paper, with shading, brushstrokes or photographic 'grain', and at the same time we see that these compose a face . . . Pictures are unique among objects for they are seen both as themselves and as some other thing, entirely different from the paper or canvas of the picture. Pictures are paradoxes.*

We can define the elements of this paradox in the vocabulary of communication and information theory.

A channel is the physical means of communication. A code is the structure imposed upon a message which permits that message to be transmitted. A code can be said to be made up of information units which are appropriate to transmission via a specific physical channel. The code is not, however, solely determined by the physical characteristics of a channel; it is also determined by cultural conventions of style, individual idiosyncracies, economics, etc. The manner in which a statement is codified determines the form of the message, and consequently influences our ability to receive and respond to the visual message.

The channel and the code together comprise the medium. Specific media attributes, that is, the ability of certain channels to transmit specific kinds of codes, can enhance or be detrimental to message content. For example, the volume of objects may be better expressed in one medium than another.

Just as the structure and vocabulary of language determine the potential and limitations on thought and expression (Whorfian hypothesis), the structure and vocabulary of visual codes impose their limits on visual communication.

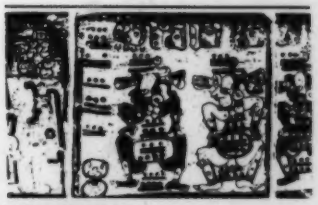
We may make a distinction between the code of the process of generating an image and the form of the message.

The medium of the mosaic may be used as an example to formulate this situation in terms of information theory. The code consists of dark and light tiles (message units) so that the dark signifies solid form against a light background. The amount of visual information, the fidelity of a representation is dependent upon the size of the code units in relation to the size of the image. In this case, the message units of the code appear to be synonymous with the message itself.

In some cases the code may be so dominant as to interfere with the actual message content. The code may then be a source of noise in that it is a signal that the sender does not want to transmit.

We can compare this with the half tone photograph used in printing today. The technique of structuring an image in terms of dark and light units has remained the same; however, the code units are so small in this case that they are below the threshold of human vision. There is no longer a direct correspondence of code unit and message unit; the code is distinct from the message.

In this case the message is transmitted in terms of relatively noninterfering codes.



It is always necessary to learn to read the code of a culture's graphic media as it is necessary to learn to interpret stylistic conventions.

14 *The easier it is to separate the code from the content, the more we can rely on the image to communicate a particular kind of information. A selective code that is understood to be a code enables the maker of the image to filter out certain kinds of information and to encode only those features that are of interest to the recipient. Hence, a selective representation that indicates its own principles of selection will be more informative than the replica.*

15 Messages cannot be extracted 'pure' from media. *Messages suffer loss of fidelity with respect to the characteristics of an original to be transmitted; they can be distorted in transmission and the 'noise' of a code or the inadequacy of a channel can obliterate them partially or entirely.*

It is, however, our limited channel capacity of vision that allows the changing intensities of a luminous dot sweeping across a television screen to appear as a stable image.

In general, we attend to the overt content of an image. But, however automatic, our reading of the image is never a passive process. Without a prior knowledge of the possibilities of representation due to cultural convention and to capacities and limitations of the media, we cannot begin to interpret them. The reading of a simple photograph may depend on our knowledge that a blurred figure is the result of its motion during the time of exposure.

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The context

The message of an image always depends on prior knowledge of possibilities. The smaller the sample space of alternative meanings, the higher the probability the correct meaning will be chosen.

The context in which we perceive a visual image may make its meaning unambiguous by restricting the number of possible meanings.

In international events such as the Olympic Games, pictorial images are used for communicating to people who speak diverse languages. Each image is simplified to emphasize the distinctive features of each of its elements. In the context of the situation, the number of possible meanings each image could have is limited. Given the limited number of expected messages and the restriction of choice, the images become self explanatory.

The caption

The image, as used for purely informative purposes, depends on words. Words provide the keys to understanding exactly what the image is about.

Even the most life like image can mislead if 16 it is incorrectly labelled: *It is only our confidence in certain formats and institutions that allays our doubts that a picture in a book, a newspaper or on the screen really shows what it purports to show.*

It may be assumed that the caption or a verbal description may make the code and the context superfluous. But the flexibility of our cultural conventions and potential interference in transmission or distortion of the message makes the redundancy reinforcing. The use of two independent channels increases the probability of correct construction by the observer, and facilitates its memorization.

17 *The information a symbol conveys is taken to be the properties of the referent that can be inferred by the symbol.*

The range of the information value of images varies according to the amount of information about the referent that they encode, that is, with their fidelity or informational correspondence.

Such representation might be termed as 'imitative informing', that is, one property of the symbol implies the very same property of its referent.

However faithful an image that serves to convey visual information may be, the process of selection will always reveal the maker's interpretation of what he considers relevant.

Some theorists, notably J. J. Gibson, have sought to determine pictorial principles that will enable portrayal of forms of objects in ways that are spontaneously meaningful.

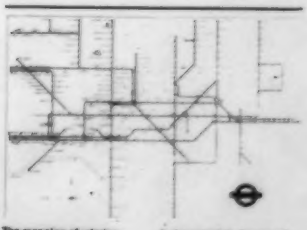
Assuming that *the more nearly a surrogate is projective or replicative the less associative learning need occur*, pictures of high fidelity should be more spontaneously meaningful.

Recent experimentation has compared pictures of high fidelity (photographs) which reproduce the optical array of light emitting from an object, with pictures that repeat only simplified optical forms or structures (simple line drawings). It was found that with regard to specific tasks, the line drawings were more informative. Gibson, having concluded that a high degree of fidelity may be counter-productive to the detection of a limited property of the subject, has redefined an informative picture as *a surface so treated that a delimited optic array to a point of observation is made available that contains the same kind of information that is found in the ambient optic rays of an ordinary environment.*

The new definition is in accord with the Gestalt view of perception that we perceive salient structural features, and therefore a simplified drawing of structural relationships may eliminate noise signals inappropriate to the detection of specific properties. The more complex an image is, the greater the competition between its visual traits; by removing details (abstraction), we simplify the task of perceiving certain relevant information.

Medical artists, for example, record information that photographs may fail to communicate. *Leonardo da Vinci's anatomical studies are early examples of deliberate suppression of certain features for the sake of conceptual clarity.*

The abstracted representations of structural features may be temporal or logical, as well as spatial.



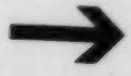
The mapping of relationships, or diagramming, allows us to see at a glance information that often would be complicated and lengthy to describe in words.

A characteristic feature of maps and diagrams is the use of captions or keys to standardized codes.

A high degree of specificity in the image calls for a correspondingly specific knowledge of the viewer if he is to understand it. Specific characterization may make it easier to identify the particulars if the viewer has the appropriate knowledge, but harder to represent more general meanings.

Through abstraction, it is possible to emphasize the fundamental characteristics of a subject (its essence) and it is therefore easier to make analogies with ideas or concepts.

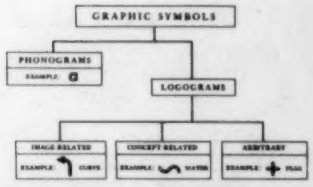
A great deal more information is presented than that which is needed for the task.



The arrow concentrates more effectively in pointing. As an abstract shape, it is more nearly a full-time symbol and therefore invites the viewer to treat it as a statement, rather than a piece of the pictorial world.

Although highly abstract images are narrow in intention, they are broad in extension, that is, they can refer to many things, depending on their context in various different situations.

Symbols of highly abstract design that bear little or no resemblance to their referents must be restricted to unique application or rely heavily on explanatory context for meaning. For example, the form of a cross can be a plus sign in mathematics, a symbol of a religion, or in the case of the cross bars of a window it has no semantic meaning at all.



When the purpose is to identify, simplification increases the distinctiveness of an image, making it more memorable and easier to produce.

Some symbol images are pictorially related to their referents, while others are concept-related.

The information extracted from an image can be quite independent of the intention of its maker. '*Cave Canem*' may provide information about the history of dog breeding.

Relative size (scale), besides being used as a depth cue, can be used to indicate the importance of figures in relation to one another.

Pictorial conventions may be based on an effort to describe objects as fully as possible rather than to show them as they appear from one viewpoint.

The expressive and exemplifying functions

In the broadest sense, the term 'expression' is equated with 'the statement of meaning'.

» *We do well to limit 'statement' to 'statement in words'. But we do not limit 'expression of meaning' to 'statement of meaning', for our whole position is just that meanings may be expressed by other means than words.*

Meaning must not be so restricted as to refer only to cognitive meaning, but also to affective or connotative meaning. *The actual state of affairs is, clearly, that feeling . . . can occur without knowing, while every instance of knowing involves some kind of feeling. Here, as in the case of cognitive meaning, something concerned as already existing is transmitted, conveyed, or aroused--except now it is emotion.*

» *Representation is of objects or events, while expression is of feelings or other properties.*

Expression sometimes reflects the inner state of an organism. It is a manifestation of behavior that may inform us as to what a person feels, thinks, and aspires to.

Expressive responses to life are generally immediate and unanalyzed; we may say that they are intuitive.

» *Until a man has expressed his emotion, he does not yet know what emotion is. The act of expressing is therefore an exploration of his own emotions. He is trying to find out what these emotions are.*

Expression exists in some form. Herbert Read has described art as a form of expression that *gives outward release to some inner pressure, some internal necessity. That pressure is generated by emotion, feeling, or sensation, and the work of art becomes a vent or safety valve through which the intolerable psychic distress is restored to equilibrium.*

We may, however, express, as an actor or a dancer does, sadness or elation when we actually are neither sad nor elated. We may paint a 'violent' picture without being angry, though the picture may seem to express anger. The expression in an image may or may not be the result of the emotional state of an individual at the time he creates it, but an expression is always the result of the qualities a symbol possesses.

For example, when we look at an image, we receive information about what the picture represents, what qualities or properties it possesses, and what feelings it expresses.

A picture may be blue; it is a physical quality it possesses. As such, the picture belongs to the class of blue things. The same picture may also be sad. However, the picture does not possess sadness as it does the color blue; the picture is literally blue, but only figuratively or metaphorically sad.

A picture denotes what it represents, exemplifies what it literally possesses, and expresses what it metaphorically possesses. Expression, then, is what is metaphorically exemplified by a symbol. Not all exemplification is expression, but all expression is exemplification.

To exemplify or express is to display rather than depict or describe. Expression exists only in that a symbol system has the properties that exemplify a given feeling or idea.

In order to express, there must be a mutual or joint transformation: an inner transformation of images, memories, emotions and of the medium, in which both acquire a form and order which they did not at first possess.

Just as the creation of these forces may be spontaneous and subjective, so may the viewer's response. All the expressions of an individual, when perceived by another person, must be interpreted if they are to be understood.

27 *In our responses to expression not less than in our reading of representation, our expectations of possibilities and probabilities must come into play. There are misunderstandings of expression as there are other false responses.*

Lineal expression seems to have real sense and order. Lines expressing such emotions as sadness, anger or happiness are readily interpreted. In a research study carried out by Reinhard Kraus, emotional states were mentioned by name and test subjects were asked to select from a series of linear patterns the ones most nearly representative of each of the named emotions. Agreement ranged to 75 percent.

sad happy angry

The generative or arousal function

28 *Preachers and teachers preceded modern advertising in the knowledge of the ways in which the visual image can affect us whether we want it or not. The succulent fruit, the seductive nude, the repellent caricature, the hair-raising horror, can all play on our emotions and engage our attention.*

Ecological stimuli

Surrogates or models can trigger the biological releasing mechanisms of animals, eliciting instinctive patterns of action. By intensifying the critical features of a surrogate, it may become more effective than a natural stimulus. There seems to be no doubt that all organisms, including man, are biologically programmed to respond to certain stimuli in ways that facilitate survival.

Images may raise arousal because of their association properties with objects or events that are injurious and noxious or beneficial and gratifying.

29 *The visual brain has its own logic and preferences, which are not understood cortically. Some objects are beautiful, others ugly; but we have no idea, for all the theories which have been put forward, why this should be so. The answer lies a long way back in the history of the visual part of the brain, and is lost to the new mechanisms which give our intellectual view of the world.*

A child may be reluctant to touch the photograph of an animal it sees as threatening or repulsive.

It has been speculated that images that are considered 'cute' or 'sweet' generate parental feelings by their structural similarity to babies.

Collative stimuli

Images in which the form is in a state of uncertainty or suspense will heighten our arousal. Such characteristics as novelty, complexity, surprise, incongruity, conflict, ambiguity, and instability trigger our cognitive drive to resolve and understand our perceptions.

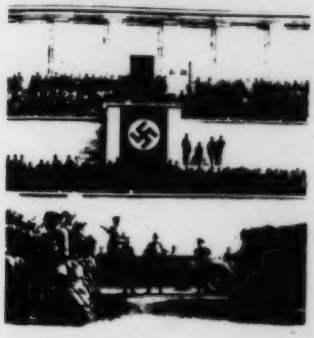
30 *The incomplete image and the unexpected image set the mind a puzzle that makes us linger, enjoy and remember the solution, whereas the prose of purely informative images would remain unnoticed and unremembered.*

Psychophysical stimuli

The arousal function of sights is not confined to definite images. Configurations of forms and colors have the potential to influence our emotions. Generally, more intense stimuli are more arousing. Also, there is some evidence that hues toward the red end of the spectrum are more arousing or stimulating than 'cooler' hues.

The arousal potential of symbols may stir the unconscious significance of certain 'archetype' forms.

Arousal creates an emotional state, which results in more energy being expended. This expenditure of energy may be directed by the nature of the arousal stimulus to a particular kind of action which would not otherwise have occurred. If an image generates a directed response, it has acted in a motivating capacity.



Symbols can be charged with associative arousal potential. The swastika, a powerful, black, angular, revolving figure in a red context, was calculated to arouse a sense of the power it symbolised.

Strange ancient symbols arouse a sense of mystery, awe and intrigue: a testimony to the power of symbols is the arousal potential of cult or religious images.

Advertisers and propagandists have thoroughly explored the possibilities of the use of images to motivate us.

The mnemonic function

Another aspect of arousal is its capacity to make information, ideas and feelings more memorable.

What we have seen stimulates recall more effectively than impulses produced by the other senses.

Images that arouse us, vivid portrayals, bold representations and unusual or unexpected views, leave a memorable impression.

The sensational image has a long tradition in newspapers, magazines, and motion pictures.

Dr. Jerome Bruner has written that:
Perhaps the most basic thing that can be said about human memory, after a century of intensive research, is that unless detail is placed into a structured pattern, it is rapidly forgotten. Detailed material is conserved in memory by the use of simplified ways of representing it.

Gestalt psychologists, through experimentation with simplified representatives, have determined that human awareness can be triggered even through incomplete visual patterns. Given enough of the salient structural aspects of form, the mind is able to 'fill in' the details.

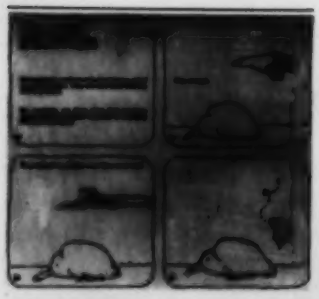
This effect has been termed 'schematic perception'. In other words, perception is based on the most telling structural features, for the smallest and most literal details are not the first assimilated nor the easiest for us to appreciate.

By removing details, we may put more emphasis on the important features, thus making the image more meaningful.

Artists have intuitively created pictorial schemata.

At the risk of oversimplification, one might say that memory is something a person does rather than something he has. This indicates involvement--an intellectual effort that accomplishes successful storage and the ability to recall.

If an image compels the viewer to provide details through imagination, or presents a puzzle, he must analyze and solve it; his 'participation' makes the image more memorable.



Images can act as mediating agents making meaningful associations in an allegorical or dramatized manner.

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12 Dondis *Visual Communication and the Graphic Arts*

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14 Gombrich, E. H. from Olson, D. R. *Media and Symbols*

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18 Gombrich, E. H. from Olson, D. R. *Media and Symbols*

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20 Ibid

21 Gombrich, E. H. from Olson, D. R. *Media and Symbols*

22 Tiganis, V. *Art and Human Intelligence*

23 Ibid

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25 Collingwood in Tiganis, V. *Art and Human Intelligence*

26 Dewey from Tiganis, V. *Art and Human Intelligence*

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31 Ibid

32 Ibid

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VITA

NAME: Greg Prygrocki

PLACE OF BIRTH: Winnipeg, Manitoba

YEAR OF BIRTH: 1948

POST-SECONDARY EDUCATION AND DEGREES:

University of Manitoba
Winnipeg, Manitoba
1967-1971 B.I.D.

HONOURS AND AWARDS:

Globerman Chair Prize
University of Manitoba
1970-1971

Graduate Research Assistantship
Athabasca University
1973-1975

RELATED WORK EXPERIENCE:

Teaching Assistant
University of Alberta
1974-1975